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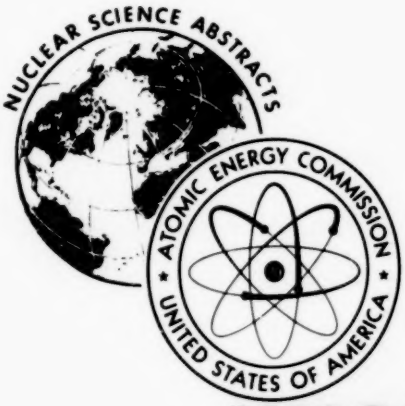

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Volume 19, Number 15, August 15, 1965

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Volume 19, Number 15 August 15, 1965

NUCLEAR SCIENCE ABSTRACTS

BIOLOGY AND MEDICINE

General

27896 (ORNL-3806) TECHNIQUES FOR HEMATOLOGICAL STUDIES OF WILD MAMMALS. Lovell L. Lewis and Paul B. Dunaway (Oak Ridge National Lab., Tenn.). June 1965. Contract W-7405-eng-26. 19p. Dep.; $2.00 (cy), 1(mn) CFSTI.

Modern instruments and techniques make possible the utilization of small amounts of blood for red and white blood cell counts, cell size distributions, hemoglobin concentrations, packed cell volumes, mean cell volumes, and electrophoretic separations of plasma protein fractions. Electronic particle counters can be used to enumerate blood cells much faster and more accurately than was heretofore possible. Hemoglobin determinations can be made from the remainder of the suspension of hemolysed blood used for leukocyte counts. Plasma from microhematocrit tubes also can be used for electrophoretic protein separations. These hematological techniques can be utilized in studies of small wild mammals from which only minute quantities of rapidly clotting blood are available. (auth)

27897 (ORNL-P-115) NATURAL WATER FRACTIONATION. I. BULK ISOLATION OF VIRUS PARTICLES. William T. Lammers (Tennessee Valley Authority, Oak Ridge, Tenn. and Oak Ridge National Lab., Tenn.). [1963]. Contract W-7405-eng-26. 13p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Particles of viral dimensions were isolated from the relatively "clean stream" conditions of Watts Bar Dam tailrace on the Tennessee River. The particles were characterized by density, absorption at 260 mμ, and electron microscopy. (auth)

27898 (UCRL-7896) PALMITYL-COENZYME A INHIBITION OF THE CITRATE-CONDENSING ENZYME. Paul A. Srere (Lawrence Radiation Lab., Univ. of California, Livermore). May 22, 1964. Contract W-7405-eng-48. 21p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

The citrate-condensing enzyme can be partially protected from palmityl-CoA inhibition by oxaloacetate. The interaction between the enzyme and palmityl-CoA led to the firm binding of 16 moles of the compound per mole of enzyme for a 27% inhibited enzyme. With a 70% inhibited enzyme little change was seen in the sedimentation behavior. It is concluded that the interaction is not physiologically significant. (auth)

27899 (OTS-63-11455/3-4) ARCHIVES OF BIOLOGICAL SCIENCES. Translation of Arhiv Biol. Nauka (Belgrade), 15: No. 3-4, 1963. 184p. $5.00(CFSTI).

Thirteen papers were presented. A separate abstract was prepared for the one paper within the scope of NSA. (H.G.D.)

For an abstract of the individual paper see: 27952.

27900 PROFESSIONAL TRAINING PROGRAMS IN VETERINARY RADIOBIOLOGY. A. R. Twardock (Univ. of Illinois, Urbana). Am. J. Vet. Res., 26: 552-5(Mar. 1965).

A discussion is given of the content and scope of courses in radiobiology that should be given to veterinary medical students. Radiobiology covers all phases of radiation physics, radiation effects, medical applications, and civil defense aspects to be taught to veterinary medical students. Many aspects of radiobiology can best be illustrated within the context of existing courses, such as: determination of blood volume by ^{51}Cr-labeled red cells as a part of physiology, radiation damage as a part of pathology; thyroid ^{131}I uptake as a part of veterinary clinics. In addition, it is felt that an organized 1- or 2-hr lecture and lab course is necessary to assure a thorough, organized development of basic information and ideas in radiobiology. An outline is given of a veterinary radiophysiology course. In addition to lectures, lab sessions are used to provide a means of maintaining the students' interest, and are the best way to obtain retention of subject matter by the student. The main difficulties in setting up lab sessions are problems of scheduling within the curriculum and providing adequate numbers of relatively expensive items of equipment. Equipment needs in the author's courses have been filled by the Division of Nuclear Education and Training of the U. S. Atomic Energy Commission which supported the training program. Each student attended two lab sessions during the semester. The 1st session, is on the use of radiation detectors, and the 2nd lab exercise is on the whole-body radiation syndrome in mice, which provides a meaningful background for the lecture sessions on biological effects. It is concluded that radiobiology has a definite place in the curriculum and research activities of the veterinary college, and that the veterinary medical profession will benefit from both the teaching of the subject and its application in the colleges and in the field. (BBB)

27901 PROBLEMS IN TRAINING VETERINARY STUDENTS AND GRADUATES IN SPECIALIST TECHNIQUES SUCH AS RADIOISOTOPE UTILIZATION. A. O. Betts (Royal Veterinary Coll., London). Am. J. Vet. Res., 26: 556-9(Mar. 1965).

The need for teaching radiobiology to veterinary students is considered, the conclusion being reached that such a course is essential. The main topics to be presented in a course of this kind are proposed, as follows: (1) The nature of radiations and their relation to the structure of matter. (2) Physical, chemical, and biological effects of radiation, with particular reference to their specific applications in veterinary medicine and their injurious effects on somatic and germ cells. Radiation pathology should be covered in the pathology and chemical pathology courses. (3) The detection and measurement of radiation, including some teaching on instruments and units. (4) Natural sources of

radiation, both internal and external. (5) Artificial sources of radiation including both radioactive isotopes and apparatus emitting ionizing radiation. (6) Chemical properties of radioisotopes including those that might not normally be covered in biochemistry. (7) Principal applications of radiations and radioactive material in biology and veterinary medicine. (8) The more important radiation hazards and aspects of protection and prevention. Items (7) and (8) should be covered to a considerable extent in the course on radiology. Essentially then, the undergraduate course would provide a general idea of the properties and uses of radioisotopes, their dangers, and a knowledge of protective measures. Postgraduate training is considered in terms of advanced training with the aim of producing specialists, and training for research. (BBB)

27902 OXYGEN TENSION IN HUMAN MALIGNANT DISEASE UNDER HYPERBARIC CONDITIONS. Dana Jamieson and H. A. S. Van Den Brenk (Cancer Inst. Board, Melbourne). Brit. J. Cancer, 19: 139-50(Mar. 1965).

Oxygen tensions were recorded continuously in tumors and normal tissues of 34 patients pressurized in pure oxygen to 4 atmospheres absolute. Mean rises to 620 mm. Hg and 320 mm. Hg for tumors and normal tissues respectively were recorded. With patients breathing air at atmospheric pressure 22/90 (24 per cent) of tumor electrodes registered pO_2 values of <4mm. Hg compared to only 2/39 (5 per cent) of normal tissue electrodes. The results obtained suggest that oxygen polarography as a method for determining pO_2 in solid tissues in vivo is complicated by many artefacts, particularly tissue damage due to electrode trauma, which reduce its value to clinical research concerned with accurate information of absolute pO_2 values in intact tissues. (auth)

27903 THE GROWTH AND FUNCTION OF THIOURACIL-INDUCED THYROID TUMORS TRANSPLANTED INTO NON-INBRED RATS THYMECTOMIZED AT BIRTH. William L. Money, Patricia Typond, and Rulon W. Rawson (Sloan-Kettering Inst. for Cancer Research, New York). Cancer Res., 25: 423-31(May 1965).

Thyroid tumors, produced in Charles River rats maintained for prolonged periods on thiouracil, were successfully transplanted into neonatally thymectomized hosts. Initial growth of the transplant was slow and required approximately a year to reach 5 to 20 gm in weight. Subtransplantation at that time, into either thymectomized or intact animals, resulted in rapid growth of the transplant within 3 months. Histologically, the tumors were variable but unmistakably thyroid in origin. Autoradiographic analysis revealed the location of radioiodine primarily in follicular types of tissue. Functionally, the tumors had the capacity to concentrate radioiodine and produce monoiodotyrosine, diiodotyrosine, triiodothyronine, and thyroxine. Chromatographic separation of the labeled fractions showed a significant increase in monoiodotyrosine and a decrease in diiodotyrosine and the iodothyronines, when compared with the host's thyroid gland. (auth)

27904 CANCER CHEMOTHERAPY. A BIBLIOGRAPHY OF AGENTS SUPPLEMENT 1955-1959. Cancer Res., 25: Suppl., Pt. 2, 637-1075(May 1965).

A bibliography composed of 4782 references on cancer chemotherapeutic agents is presented that reflects not only their therapeutic use in the cancer patient and their tumor-inhibiting effect in animals, but in the case of well-established agents, their pharmacological and physiological influence, their metabolism, mode of action, and toxicity. Action of agents on plant tumors and microorganisms is included. Both in vivo and in vitro studies and screening tests are cited. Reports on controversial agents are also listed; as well as clinical use of hormones and endocrine ablation in cancer management, mutagenic or carcinogenic action, and structure-activity relationships. (H.G.D.)

27905 CYTOLOGY OF HUMAN BONE MARROW SUBJECTED TO PROLONGED STORAGE AT – 79°C. D. E. Pegg (Westminster Hospital, London). J. Appl. Physiol., 19: 301-9(Mar. 1964).

As part of a research program which included use of autologous bone marrow infusions for cancer therapy in irradiated patients, it became necessary to store human bone marrow for considerable periods of time. The glycerol low-temperature technique was used for this purpose. Thus human bone marrow cells preserved at – 79°C with 15% glycerol exhibited marked morphological changes when examined by conventional cytological methods. Techniques designed to remove glycerol slowly produced still more damage. By contrast, cells from which the glycerol was removed rapidly by abrupt dilution in an isotonic medium were found to be morphologically intact when examined on cellulose acetate membrane filters: the quantitative recovery was 74%, and undoubted proof of viability was provided by the demonstration of motile cells. When bone marrow was examined after storage for periods up to 3½ yr, it was noted that a progressive loss of cells occurred. A variety of cytological techniques, including staining by Romanowsky, Feulgen, PAS, Sudan black, and pyronin techniques and supravital staining with acridine orange and trypan blue all provided further evidence of progressive deterioration during storage at – 69 to – 79°C. These results suggest that the technique of bone marrow preservation, using 15% glycerol, slow cooling, and storage with solid carbon dioxide is effective for short terms, but since definite deterioration occurs during storage, other techniques, possibly including the use of dimethyl sulfoxide and lower storage temperatures will be required for longer storage periods. (BBB)

27906 ELECTROPHORETIC STUDIES ON SERUM AND TISSUE PROTEINS OF THE LIVER AND TUMORS IN PATIENTS BEARING MALIGNANT TUMORS. PART II. ELECTROPHORETIC STUDIES ON TISSUE PROTEINS OF LIVER AND TUMORS OF ORGANISMS BEARING MALIGNANT TUMORS AND THE EFFECT OF IRRADIATION AND OTHER AGENTS ON THEM. ELECTROPHORETIC STUDY OF UTERUS CANCER TISSUE PROTEIN. Hirokazu Kaji (Kyoto City Univ.). Sanfujinka No Shinpo, 14: 271-6(Nov. 1962). (In Japanese)

Preliminary to an investigation of the effect of radiation on tissue proteins, an electrophoretic study was made of cervical cancer protein by comparing it with that of normal tissue protein. The cancer tissue specimens were taken from 18 patients, and normal tissue sample as a control was taken from the healthy endometrium of the same patients. The tissue specimens were minced and rinsed thoroughly with cold 0.05M phosphate buffer solution to remove blood proteins completely. Soluble tissue protein was then extracted from the specimens with the phosphate buffer (pH 7.8, ionic strength 0.144), 5 ml/3 g of tissue. The specimens were homogenized, frozen, and cooled to –15°C for 18 to 24 hr to completely rupture the cells. The homogenate was thawed at room temperature and then centrifuged at 23,000 x g for 30 min at 0°C. The upper fraction of clear supernatant containing soluble protein was dialyzed for 24 hr, and recentrifuged. This protein was subjected to electrophoretic examination. The N content of the specimen was determined by the micro-Kjeldahl method, and the concentration of the soluble protein by refractometry. The concentration of the solution was kept at least 1.0 to 1.5 g/100 ml. The results show that the N and soluble protein content of the cervical cancer tissue did not differ significantly from that of the normal tissue. The soluble proteins of the cancer and normal tissue specimens were fractionated into six peaks in the electrophoretic pattern, the third of these peaks being most prominent. Compared to the control, the cancer tissue protein showed a decrease in the second and third fractions and an increase in the fourth and fifth fractions. (BBB)

27907 QUALITATIVE AND QUANTITATIVE STUDIES OF THE COURSE OF ANTIBODY PRODUCTION. I. OBSERVATION OF THE COURSE OF ANTIBODY PRODUCTION AGAINST HUMAN SERUM. Iwao Okano (Tokyo Univ.). Tokyo Igaku Zasshi, 67: 1510-21(Dec. 1959). (In Japanese)

In preliminary experiments for the study on the influence of x irradiation upon antibody formation in the rabbit, the course of antibody production was followed after single and repeated injections of human whole serum. Special attention was paid to the development of antibodies against individual serum fractions. By combined observations of the patterns of positive precipitation reactions, gel diffusion technique, and immunoelectrophoresis, it was found, among other findings, that the antibodies against α-globulin and β-globulin generally appear first, followed by anti-γ-globulin antibodies, and finally the antibodies against serum albumin. The importance of these findings for analytical observations in serology studies are discussed. (BBB)

27908 CURRENT TOPICS IN RADIATION RESEARCH. VOLUME I. Michael Ebert and Alma Howard, eds. Amsterdam, North-Holland Publishing Co., 1965. 277p.

Papers are presented on six areas of rapid development in radiobiological research; separate abstracts were prepared for five. One paper was abstracted previously in NSA, see 19: 17697. (H.G.D.)

For abstracts of individual papers see: 28106, 28107, 28108, 28124, and 28125.

27909 PROCEEDINGS OF THE AMERICAN MEDICAL ASSOCIATION CONGRESS ON ENVIRONMENT HEALTH PROBLEMS, MAY 1-2, 1964, CHICAGO, ILLINOIS. Can Some Diseases Be "Engineered" Out of the Environment? Chicago, American Medical Association, 1964. 112p. (CONF-623). $2.00

Twenty-two papers were presented on: air pollution, pesticide hazards, radiological hazards, and water supply and pollution control. Separate abstracts were prepared for two papers; two papers were previously abstracted in NSA, see 18: 33401 and 19: 2186. (H.G.D.)

For abstracts of individual papers see: 28604 and 28605.

Ecology

Refer also to abstract 28546.

27910 (UWFL-86) RADIONUCLIDES OF COLUMBIA RIVER ORIGIN IN MARINE ORGANISMS, SEDIMENTS, AND WATER COLLECTED FROM THE COASTAL AND OFFSHORE WATERS OF WASHINGTON AND OREGON, 1961-1963. Allyn H. Seymour and Gary B. Lewis (Washington Univ., Seattle. Lab. of Radiation Biology). Dec. 10, 1964. Contract AT(45-1)-1385. 78p. Dep.; $3.00 (CFSTI).

A program was conducted to determine the distribution of Hanford-produced radionuclides in the marine environment. Zinc-65 measurements were made in coastal organisms, offshore plankton, demersal fish, and water collected in surveys in 1961 through 1963. The ratio of ^{51}Cr to ^{65}Zn in water samples was determined. Annual, seasonal, and areal differences were studied. Other radionuclides also determined included ^{32}P, fallout radionuclides, and ^{40}K. (D.L.C.)

Metabolism, Tissue Distribution, and Toxicology

27911 (AWRE-O-46/65) THE DISTRIBUTION OF PLUTONIUM IN SERUM PROTEINS FOLLOWING INTRAVENOUS INJECTIONS INTO RATS. G. Boocock and D. S. Popplewell (Atomic Weapons Research Establishment, Aldermaston (England)). May 1965. 17p. Dep.(mn); $0.50(BIS), 2s. 6d. (HMSO).

The separation of serum proteins by molecular sieves is described. Automatic counting after irradiation in HERALD shows that plutonium is associated with transferrin, the iron-binding component of blood serum proteins. (auth)

27912 (TID-19014) AN EVALUATION OF QUANTITATIVE RADIOAUTOGRAPHY USING LIQUID SCINTILLATION BETA SPECTROMETRY. Progress Report. Bertram F. Woolfrey (Minnesota Univ., [St. Paul]). June 15, 1963. Contract AT(11-1)-1089. 10p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Quantitative radioautography and simultaneous liquid scintillation beta spectrometry were applied to mice with melanomas who were injected with tritiated thymidine. In the radioautographic procedure, tumor tissues were sectioned and dipped into liquid emulsion; after exposure and development, grain counts were made. In the beta spectrometric procedure, tissue sections were combusted, and the resulting tritiated water vapor was counted in scintillator solution. The results show that quantitative radioautographic procedures can be applied to frozen section material and that liquid scintillation beta spectrometry can be used to replace long hours of grain counting. (D.L.C.)

27913 (UCRL-Trans-1196(L)) DETERMINATION OF THE RATE CONSTANTS FOR THE ELIMINATION OF ^{210}Pb FROM VARIOUS TISSUES OF THE RAT. N. Castellino and S. Aloj. Translated by D. Finlay (Univ. of California, Livermore), from Folia Med. (Naples), 47: 238-48(1964). 12p. Dep.(mn); $1.60(fs), $0.80(mf) JCL.

The elimination of ^{210}Pb from rat tissues was studied after a single intravenous injection of 100 μg of lead (as lead acetate). The curves showing the changes in the concentration of the metal in the various organs and tissues are expressed analytically by a sum of exponential functions. Thus lead is eliminated in various stages. In the case of blood, plasma, hematic cells, and the other tissues examined, two rapid stages and a final slow stage are observed, whilst only one fast stage and one slow are found for the liver and kidneys. The elimination of the metal from bone tissue, on the other hand, proceeds at an extremely slow, constant rate. The interpretation of the results suggests a complex lead metabolism. The fast stages could correspond to the elimination of lead which is present as ions in the intercellular spaces or weakly bound to the cells, whilst the slow stage probably corresponds to the elimination of metal which has been converted to organic complexes. (auth)

27914 INFLUENCE OF DIGITOXIN AND k-STROPHANTHIN INFUSION WITHOUT AND WITH $CaCl_2$ ON THE RELATIVE ^{45}Ca UPTAKE OF THE HEART. W. Foerster and H. H. Deike (Pharmakologisches Institut der Medizinischen Akademie, Magdeburg, Ger.). Acta Biol. Med. Ger., 11: 842-8(1963). (In German)

Previous experiments indicated that Ca has variable effects on the toxicity of cardiac glycosides, according to the compound tested. The present experiments with ^{45}Ca were conducted in an attempt to elucidate the mode of action of Ca on glycoside toxicity. In guinea pigs which were given lethal doses of digitoxin and k-strophanthin by means of an infusion apparatus, comparison was made of a simultaneous infusion of a 2% $CaCl_2$ solution upon the toxicity and upon the relative ^{45}Ca uptake by the heart. Whereas the ^{45}Ca uptake was not influenced by toxic doses of digitoxin, the heart content of ^{45}Ca increased by more than 30% under a k-strophanthin infusion. Simultaneous 2% $CaCl_2$ - $^{45}CaCl_2$ infusion considerably potentiates the digitoxin toxicity and leads to a 139% increase of the ^{45}Ca content in the heart. With k-strophanthin the $CaCl_2$ infusion has no influence upon the LD_{100} values, and the ^{45}Ca content in the heart increases by only 62%. Whether the lower Ca uptake by the heart with k-strophanthin is related to the lesser degree of enhancement of this glycoside's toxicity was not revealed by the present experiments. (BBB)

27915 SEXUAL DIFFERENCE IN THE ^{131}I UPTAKE BY THE SALIVARY GLANDS IN THE HAMSTER. C. E. Epper, O. L. Catanzaro, and A. B. Houssay (Universidad, Buenos Aires). Acta Physiol. Latinoam., 14: 269-73(1964).

A sexual difference in the ^{131}I uptake by the submaxillary glands, which is greater in males than in females, has been

found previously in several strains of mice. This sexual difference was not found in retrolingual or parotids (the salivary glands of the rats do not concentrate ^{131}I). Since the submaxillary glands of other rodents, such as hamsters, are able to concentrate ^{131}I, experiments were done to find out if there is a sexual difference in this concentration. Male and female hamsters (Mesocricetus auratus), 3 to 4 months old, were injected intraperitoneally with a tracer dose of 10 μC of ^{131}I (carrier-free) and were killed 1, 4, or 8 hr later. Submaxillaries concentrate ^{131}I, as shown by the serum level 1, 4, or 8 hr after the tracer dose. In the 4- and 8-hr measurements the submaxillary/serum ratio was significantly higher in males than in females. Analysis of the results shows that serum ^{131}I concentrations were lower in females than in males but the principal difference between them was the higher ^{131}I uptake by the submaxillaries in the males. The retrolingual/serum ratio was higher than 1 only 8 hr after the tracer dose. At that time it was significantly higher in males than in females. The parotid/serum ratio was higher than 1 only at 8 hr after the tracer dose was given. At that time it was significantly higher in males than in females. In the case of the parotid and retrolingual glands it could not be determined whether an actual concentrating ability was demonstrated or whether the results reflect factors modifying salivary gland secretion of iodide or blood levels of iodide. However, the concentrating mechanism is especially evident in the submaxillaries whose granular and tubular development is much greater than that of the other two glands. (BBB)

27916 LEACHING OF METABOLITES FROM FOLIAGE AND SUBSEQUENT REABSORPTION AND REDISTRIBUTION OF THE LEACHATE IN PLANTS. H. B. Tukey, Jr., and R. A. Mecklenburg (Cornell Univ., Ithaca, N. Y.). Am. J. Botany, 51: 737-42(Aug. 1964).

When Ca and Sr were leached from plant foliage and subsequently incorporated into the root medium of the same or other plants, they were reabsorbed by the roots and translocated to above-ground portions of the plants. Experiments were designed to investigate this recycling phenomenon, to determine whether it is widespread in nature, and to evaluate its implications more fully. Squash seeds (Cucurbita melopepo) were germinated in moist Perlite and transferred to half-strength Hoagland's standard nutrient solution. Then 25 μC of ^{45}Ca, ^{32}P, or ^{89}Sr were added to the root medium per 3.5 liters of solution, and the radioisotopes were absorbed by the roots as the plants grew. After 2 weeks, the leaves of each plant were leached by immersion in 130 ml of aerated distilled water for 24 hr. The roots of seedlings and rooted cuttings of several plants were placed in the aerated radioactive leachate. After 2 days to 2 weeks in the radioactive leachate, depending upon the species, plants were harvested, oven-dried, and assayed for radioactivity with a Geiger-Müller detector. In this way, it was shown that ^{45}Ca, ^{32}P, and ^{89}Sr absorbed by roots, and ^{14}C absorbed as $^{14}CO_2$ by foliage were leached from squash leaves and were subsequently reabsorbed by the roots and translocated to the above-ground parts of several plant species. This phenomenon of nutrient recycling is apparently a widespread natural phenomenon and has implications in plant nutrition. Bean plants were grown through one complete generation on the leachates from squash leaves. Leaching and reabsorption of the leachates are important in the distribution of fallout products, in the stimulation and suppression of plants beneath the spread of other plants, in plant competition, and in the development of plant associations. (BBB)

27917 THE BEHAVIOR OF IODINE-131 IN THE MUSCLE OF MICE WITH HEREDITARY MUSCULAR DYSTROPHY AS AFFECTED BY AGE, CERTAIN PHARMACOLOGIC AGENTS, AND OTHER FACTORS. Robert F. Borgman (Clemson Univ., Clemson, S. C.). Am. J. Vet. Res., 26: 169-73(Jan. 1965).

Preliminary studies showed increased uptakes of injected ^{45}Ca, ^{134}Cs, ^{42}K, ^{24}Na, ^{86}Rb, and ^{32}P (as phosphate) in dystrophic mouse muscle, whereas uptakes of ^{42}K, ^{32}P (as phosphate), and ^{86}Rb into the myocardium were greater than normal. The increased uptake of ^{86}Rb and ^{32}P by the muscle and myocardium of dystrophic mice was greatest early in the disease. Attempts were then made to determine if ^{131}I would enter dystrophic mouse muscle in abnormal amounts, and if any deviations from the normal could be employed in a screening procedure for possible therapeutic measures. In mice with hereditary muscular dystrophy given ^{131}I intraperitoneally, its entrance into myocardium and skeletal muscle was observed 2 hr later. Entrance into the myocardium of dystrophic mice was increased early in the disease, as compared with normal littermates, and was near normal later in the disease. Entrance into dystrophic mouse muscle was quite high early in the disease when muscle degeneration was relatively mild; increased ^{131}I entrance was less marked later in the disease when muscle degeneration was severe. The increased uptake of ^{131}I in dystrophic mouse muscle was not observed in severely dystrophic muscle in vitamin E-deficient rabbits, indicating a difference between the inherited disease in mice and the nutritional disease in rabbits. Entrance of ^{131}I into dystrophic mouse muscle was reduced to near normal or below with injections of the following compounds: acetylcholine in large doses, d-tubocurarine, diisopropyl fluorophosphate, or ^{131}I sufficient to suppress the thyroid gland. A high protein diet or injections of procaine or sodium selenite tended to reduce ^{131}I entrance into muscle. Since a high-protein diet or ^{131}I suppression of the thyroid gland or both increased survival time of dystrophic mice, the entrance of ^{131}I into dystrophic mouse muscle may have some value in determining the efficacy of treatments. Use of ^{131}I for this purpose has the advantage of being relatively inexpensive, of having convenient half-life for use and disposal purposes, and of having radiations of a type which do not require extensive manipulations of the tissue samples before counting. (BBB)

27918 UTILIZATION OF A STABLE ISOTOPE OF OXYGEN BY PSEUDOMONAS FLUORESCEINS. Robert M. Arthur (Rose Polytechnic Inst., Terre Haute, Ind.). Appl. Microbiol., 12: 289-91(July 1964).

Oxygen-18 was used to study the pathway of oxygen consumption in bacteria. Its usefulness in measuring total 0 utilization of bacteria during respiration, i.e., the formation of $H_2{}^{18}O$, was explored by studying the respiration of a single species of bacteria with a simple reproducible substrate. The amount of $H_2{}^{18}O$ present in the suspension was measured at different times during the run. The amount of $H_2{}^{18}O$ formed during a time period was considered to be the amount of 0 utilized during that same time period. Exchange reactions with ^{16}O and biological preference for ^{18}O or ^{16}O were considered in the design of the experiment, but information taken from the literature indicates that with proper precautions both exchange and preference reactions can be minimized. Exchange can be prevented by working in neutral pH. In addition, CO_2 was continuously swept out of the culture and absorbed in a solution of NaOH to minimize its contact time with $H_2{}^{18}O$. When ^{16}O was used, the concentration of $H_2{}^{18}O$ after 175 min of aeration was 0.2027 at%. This result is about 0.6% less than the value of 0.2039 at% given as the natural concentration of ^{18}O. If there were preference for either ^{16}O or ^{18}O during the 175-min aeration period, the concentration of $H_2{}^{18}O$ should change accordingly. Only an extremely slight preference for ^{16}O is evident from these results. Among other factors, the magnitude of exchange should be directly related to concentration gradient and time. If exchange reactions are present, they are not in evidence until after 200 min of aeration time. Total production of $H_2{}^{18}O$ was about equal for different runs in spite of the fact that time differed by a factor of two and the dry cell weight was equal. These results indicate that 0 utilization of a culture of P. fluoresceins, as defined here, can be measured by use of a stable isotope of oxygen. Preference reactions do not present a problem in this technique. The results indicate that exchange reactions are influenced by time. (BBB)

27919 TRITIUM LABELLING AND ORGAN DISTRIBUTION OF A BASIC POLYPEPTIDE WITH A LEUCO-

TACTIC AND PERMEABILITY PROMOTING EFFECT. M. Frimmer (Universitat, Giessen, Ger.). Arch. Exptl. Pathol. Pharmakol., 246: 368-74(Jan. 10, 1964). (In German)

A histone polypeptide extracted from calf thymus was labelled with ^3H. To accomplish this 220 mg of the isolated polypeptide was dried over P_2O_5 and reacted with 7 C of ^3H gas for 14 days. After removal of the excess gas the sample was dissolved in 20 ml of H_2O and dialyzed at 5°C 10 times against 1 l of phosphate buffer. During these dialyses the loosely bound ^3H was removed by exchange. Also, histone decomposition products of lower mol wt were removed by this means. Dialysis was carried out until no more radioactivity was detected in the outflowing liquid. Several days were required for this. The tritiated polypeptide was chromatographed on Sephadex. Five nondialyzable fractions were separated in this manner and studied spectrophotometrically, radiometrically, and by the biuret reaction. Only three of the fractions were closely similar spectrophotometrically to the original histone polypeptide. The specific activity of the fractions used amounted to 2×10^8 C/min/mg of polypeptide. Permeability properties of the labelled polypeptide was estimated by means of a rabbit skin test. After intravenous injection into rabbits the highest concentrations were found in kidney, liver, spleen, and lungs. The radioactivity of the polypeptide in the urine was dialyzable. (BBB)

27920 THE EFFECT OF DIETHYLENETRIAMINE-PENTACETIC ACID (DTPA) ON THE LEVELS OF RADIO-EUROPIUM ADMINISTERED INTRAVENOUSLY TO RATS. T. Trnovec, M. Beno, A. Pleskova, V. Rusek, and M. Tatara (Inst. of Hygiene, Bratislava). Bratislav. Lekarske Listy, 44: 201-4(Aug. 1964). (In Czech)

Wistar rats weighing 145-155 g were injected with a 1-ml solution of $^{152}EuCl_3$ (1 μC), which was followed by injections of the chelating agent, also in 1-ml solution containing 40 mg (100 μmole). Measurements were subsequently made on the cpm values of ^{152}Eu in various tissues, and percentage values of injected dose were tabulated. Two intraperitoneal injections of $CaNa_3$ DTPA administered 24 and 72 hr following intravenous administration ^{152}Eu considerably lowered the ^{152}Eu concentrations in the liver, skeleton, and other organs. In the epiphyses and metaphyses of long bones of the rat ~ equal concentrations of ^{152}Eu were found four days after intravenous injection of ^{152}Eu. The drop in the ^{152}Eu concentration in both these bone areas under the effect of DTPA was about the same. The comparative effectiveness of this and other chelating agents, such as ethylenediaminetetraacetate (EDTA), for reducing the body burden of ^{152}Eu was also considered. (BBB)

27921 SEASONAL CHANGES IN IODINE METABOLISM. I. IODINE CONTENT OF COWS' MILK. G. D. Broadhead, I. B. Pearson, and G. M. Wilson (Sheffield Univ., Eng.). Brit. Med. J., 1: 343-5(Feb. 6, 1965).

An isotope dilution method employing ^{131}I was used to assay the I content of samples of liquid and dried milk from Yorkshire and Scotland during the years 1959 to 63. A definite seasonal fluctuation was apparent. The concentration of I in liquid milk rose during the early months of the year to a maximum of about 20 μg/100 ml in March and April. Thereafter it declined to a minimum value of about 1 μg/100 ml in August and September. It rose slowly during the last three months of the year. A similar variation occurred in dried milk. The I content of the foodstuffs supplied to cows throughout the year was measured in relation to the changes in the milk. The large seasonal change was due to the feeding during the winter months of cattle cake to which I had been added in large amounts. It occurs in both liquid and dried milk. In the latter, which may be used for infant-feeding, the seasonal fluctuation could make a considerable difference in the I intake if a baby happened to be fed largely on either the summer or winter product. It is clearly preferable that the supplement should be standardized and continued throughout the summer. This could be done by including it in the grazing cake which the cows consume while being milked during the summer months. In this way it should be possible to ensure that the iodine content of milk did not fall below 15 μg/100 ml, which would be a strong safeguard against the development of iodine deficiency. (BBB)

27922 SEASONAL CHANGES IN IODINE METABOLISM. 2. FLUCTUATION IN URINARY IODINE EXCRETION. G. D. Broadhead, I. B. Pearson, and G. M. Wilson (Sheffield Univ., Eng.). Brit. Med. J., 1: 343-5(Feb. 6, 1965).

An isotope dilution technique using ^{127}I was used to measure daily excretion of I in the urine over a week in 29 healthy subjects on unrestricted diets. Considerable variation was evident from day to day and little reliance could be placed on a single 24-hr collection. The mean urinary I excretion correlated closely with the weight of the subject. Approximately 60% of a single supplement of 500 μg of I taken by mouth was recovered in the urine. A meal of sea fish sometimes increased urinary I excretion, but the effect was variable owing to wide differences in the I content of fish. A seasonal change in excretion of I was apparent; the amount excreted declined during the summer, so that in the period July to September it was half that encountered during the winter. This decrease was due to the fall in the concentration of I in milk during the summer months. Milk in winter is thus a regular important daily source of I in contrast to the occasional consumption of fish, and is probably particularly significant in childhood. The rich supply of I in the milk in winter constitutes the main safeguard against the development of I deficiency. (BBB)

27923 INTESTINAL ABSORPTION OF ^{45}Ca IN STONE-FORMING PATIENTS. A. Caniggia, C. Gennari, and L. Cesari (Universita, Siena, Italy). Brit. Med. J., 1: 427-9 (Feb. 13, 1965).

In six stone-forming patients the intestinal absorption of ^{45}Ca was studied. It was found that all six patients examined were calcium-hyperabsorbers. It is concluded that determination of the intestinal absorption of ^{45}Ca in patients with formation of calcium concretions proves such patients to be calcium-hyperabsorbers. The principal metabolic abnormality in some patients with calcium nephrolithiasis could be an increased intestinal absorption of calcium. (auth)

27924 SPONTANEOUS AND STIMULATED EXCRETION OF CESIUM^{137} IN RATS. S. M. Stojadinovic, N. A. Pavlovic, M. M. Jovanovic, D. Dj. Tanasijevic, and V. M. Babovic. Bull. Boris Kidrich Inst. Nucl. Sci., 15: 263-72(Oct. 1964).

The spontaneous excretion with feces and urine of ^{137}Cs injected intraperitoneally in male rats in the form of cesium sulfate solution was studied as a function of the injected dose. The effects of the diuretics hydrochlorothiazide, acetazolamide, and salyrgan on cesium excretion was also followed for seven days after injection of a dose of 50 μC. Hydrochlorothiazide and, to some extent, acetazolamide, stimulated cesium excretion. (D.C.W.)

27925 THE DISTRIBUTION OF ^{137}Cs IN THE ORGANS OF RATS UNDER CONDITIONS OF SPONTANEOUS AND STIMULATED URINARY EXCRETION. N. A. Pavlovic, S. M. Stojadinovic, M. M. Jovanovic, D. Dj. Tanasijevic, and V. M. Babovic. Bull. Boris Kidrich Inst. Nucl. Sci., 15: 273-83(Oct. 1964).

The effects of the diuretics hydrochlorothiazide, acetazolamide, and salyrgan on the distribution of ^{137}Cs in the organs of rats were investigated. The results indicated that most of the intraperitoneally injected ^{137}Cs is deposited in the muscles, including the heart and diaphragm and that Cs is readily excreted from the spleen, liver, and bones. Cerebral tissue was the slowest to bind cesium. (D.C.W.)

27926 STUDIES ON HUMAN GROWTH HORMONE. I. RADIOIODINATION. David R. Hadden and Thaddeus E. Prout (Johns Hopkins Univ., Baltimore). Bull. Johns Hopkins Hosp., 116: 110-21(Feb. 1965).

Preliminary to development of a sensitive immunoassay technique, human growth hormone (HGH) was labeled with radioiodine at two levels of specific activity. It was ex-

amined by a number of different techniques to determine some of the effects of radioiodination since it was not known to what extent the hormone is altered by the described technique of labeling with radioiodine whether: (1) by the chemical reaction, (2) by the effect of added I atoms on the molecular structure of the hormones, (3) by the effect of external radiation during the labeling procedure, or (4) by subsequent self-irradiation of the iodinated molecule. In the described procedure, HGH, 5 or 25 μg in 25 μl of phosphate buffer (pH 7.5, 0.05M) was added to 50 μl of radioiodide solution (2 mC/ml ^{131}I) in a test tube. To this mixture was added 88 μg of chloramine-T in 25 μl of phosphate buffer. Iodine-131, liberated from sodium iodide-^{131}I by the action of the chloramine-T, was attached to available sites (presumably the tyrosine residues) on HGH. At the end of one min, 240 μg of sodium metabisulfite in 100 μl phosphate buffer was added, followed by 3 μg of potassium iodide in 0.3 ml. phosphate buffer. The ^{131}I-labeled HGH was separated on a Sephadex G50 column with 0.05M barbital buffer. Radio-growth hormone of high radioactivity (138 μC/μg HGH) became degraded in a relatively short period, probably as a result of self-radiation. This product should be avoided, therefore, in the immunoassay of endogenous growth hormone in biologic fluids. Radio-growth hormone of low radioactivity (17.6 μC/μg HGH) remained stable. It appears likely that HGH with low radioactivity (0.033 atoms of ^{131}I per molecule of HGH) is more likely to behave like unlabeled HGH than is HGH labeled with high radioactivity. (BBB)

27927 LABELLING OF THE ADULTS OF CHILO PARTELLUS SWINHOE (C. ZONELLUS), THE STALK BORER OF MAIZE AND JOWAR, WITH RADIOACTIVE PHOSPHORUS (^{32}P). Snehamoy Chatterji, G. R. Sethi, M. W. Bhamburkar, and M. G. Deshmukh (Indian Agricultural Research Inst., New Delhi). Current Sci. (India), 33: 652-3(Nov. 5, 1964).

Fully formed caterpillars of C. partellus were starved for 17 hr, then fed fresh maize stems treated with ^{32}P. These caterpillars were allowed to feed for two hr and were washed thoroughly with water to remove surface contamination and then assayed for radioactivity. Fresh untreated maize stems were provided to them for further development. Each radioactive pupa was separated and kept in a tube until emergence of the adult. The activity of the adult moth was recorded on emergence. These moths were then separated into males and females and pairs kept separately for mating and egg-laying. The egg masses were assayed for radioactivity, and transferred to glass rearing jars for hatching. The eggs hatched within 4 to 6 days. On hatching, first instar caterpillars were also assayed for radioactivity. The initial radioactivity ranged between 33 and 53 cpm. Radioactivity in the subsequent instars (second to fourth) ranged from 6 to 29 cpm, whereas, in the adults it ranged between 2828 and 22759 cpm. When the adults were allowed to mate they laid fertile eggs with detectable radioactivity. Thus activity could be recorded not only in the adults but also in the subsequent generation up to 4th instar caterpillars. This observation may be useful in undertaking studies on the flight range and dispersal pattern, which would not be limited to the recovery of the liberated adults but also, in cases where the adults escape recovery, the range of flight will be evident from the location of the radioactive egg masses or the caterpillars which retain radioactivity up to the 4th instar. (BBB)

27928 NATURE OF THYROID SECRETION IN THE RAT AND THE MANNER IN WHICH IT IS ALTERED BY THYROTROPIN. Kunio Matsuda and Monte A. Greer (Univ. of Oregon, Portland). Endocrinology, 76: 1012-21(June 1965).

The identity of radioiodine-labeled substances secreted into the thyroid venous effluent of the rat was determined 24 hr after ^{131}I administration. Only iodide, thyroxine, and a small and inconstant amount of triiodothyronine were secreted under basal conditions. Intravenous administration of 1 to 5 USP units of TSH caused a prompt rise in the quantity of labeled substances secreted and a pronounced qualitative shift in their composition. Diiodotyrosine and, occasionally, monoiodotyrosine were clearly detected after, but not before, TSH administration. Compared to the quantity of these substances secreted under basal conditions, TSH increased the secretion of radioiodinated components in the following order: triiodothyronine > iodide > thyroxine. The relative increase in diiodotyrosine secretion was possibly greater than that of triiodothyronine but could not be quantitated precisely since diiodotyrosine was undetectable under basal conditions. (auth)

27929 STRUCTURAL STABILIZATION OF THE MITOTIC APPARATUS BY HEAVY WATER; IN THE CLEAVING EGGS OF ARBACIA PUNCTULATA. INCREASED RESISTANCE TO PRESSURE-INDUCED DISORGANIZATION. D. Marsland and A. M. Zimmerman (New York Univ., New York; Univ. of Toronto; and Marine Biological Labs., Woods Hole, Mass.). Exptl. Cell Res., 38: 306-13 (May 1965).

Eggs (Arbacia punctulata) were immersed in D_2O–sea water at metaphase to anaphase of the first cleavage division and then subjected to hydrostatic pressure (8000 to 12,000 psi) 4 min later. Immediately subsequent to the pressure treatment, isolation of the mitotic apparatus was initiated, using the ethanol-digitonin method of Mazia. The mitotic apparatus of eggs immersed in 90% D_2O–sea water showed a very marked increase in resistance to the disorganizing (solational) effects of high pressure. Isolates derived from eggs exposed for 3 min to 12,000 psi retained plainly linear and radial configurations in the spindle and astral regions respectively; whereas non-deuterated control eggs lost all vestiges of structure after a 1 minute exposure to only 10,000 psi. Moreover, 90% deuterated eggs yielded clearly structured mitotic figures after exposures to 10,000 psi (4 min) and 8000 psi (5 min). However, similarly pressurized non-deuterated eggs gave isolates which were completely devoid of visible organization. And finally, the chromosomes of the non-deuterated isolates were swollen and clumped irregularly. A lesser degree of stabilization was observed in mitotic apparatus derived from eggs in 70% and 50% D_2O–sea water. (auth)

27930 THE REACTION OF AORTIC ENDOTHELIUM OF THE RABBIT TO HYPERLIPEMIA AND COLLOIDAL THORIUM. W. J. S. Still and Patricia R. Prosser (Royal Free Hospital, London). J. Atherosclerosis Res., 4: 517-26(Nov.-Dec. 1964).

Electron microscopic studies of vascular endothelium were conducted in rabbits fed a diet supplemented with cottonseed oil and cholesterol and injected intravenously with 5 ml of a 10% colloidal solution of ThO_2 (Thorotrast). Particles of ThO_2 were found on the surface and in the subendothelial space. The scatter of Th in the endothelium as a whole seemed quite random. Intracellularly, Th was confined to structures the size and shape of mitochondria, although the precise nature of these organelles was obscured by the dense accumulation of particles. No Th was found in vesicles smaller than these, for example of the size associated with pinocytosis; nor were particles found in or around the intracellular junctions between endothelial cells. In the subendothelial space the Th was free. There was no appearance to suggest that intracellular vesicles containing Th discharge their contents into the subendothelial space. Although Th was taken up by the normal endothelium, it was present in the endothelium of the cholesterol-fed animals in much larger amounts and in a greater number of cells. In all endothelium subjected to hyperlipemia and Th, the structures containing lipid were quite separate from those containing Th, and no mixture of the two substances was observed. The results indicate that when lipid is taken up from the blood by the aortic endothelium and is visible within the cell, it is contained within separate and different organelles as compared with colloidal Th also abstracted from the blood. This suggests that abstraction of these materials is in different and separate ways. (BBB)

27931 ELECTRON MICROSCOPY OF ABSORPTION OF TRACER MATERIALS BY TOAD URINARY BLADDER EPITHELIUM. Jae Kwon Choi (Univ. of Washington, Seattle and Univ. of California, San Francisco). J. Cell Biol., 25: No. 2, Pt. 1, 175-92(May 1965).

The absorption of Thorotrast and saccharated iron oxide by the epithelium of the toad urinary bladder was studied by electron microscopy. Whether the toads were hydrated, dehydrated, or given Pitressin, no significant differences in transport of colloidal particles by epithelial cells were observed. This implies that these physiological factors had little effect on the transport of the tracer particles. Tracer particles were encountered in three types of epithelial cells which line the bladder lumen, but most frequently in the mitochondria-rich cells. Tracer materials were incorporated into the cytoplasm of epithelial cells after being adsorbed to the coating layer covering the luminal surface of the cells. In the intermediate stage (1 to 3 hours after introducing tracer) particles were present in small vesicles, tubules, and multivesicular bodies. In the later stages (up to 65 hours), the particles were more commonly seen to be densely packed within large membrane-bounded bodies which were often found near the Golgi region. These large bodies probably were formed by the fusion of small vesicles. Irrespective of the stages of absorption, no particles were found in the intercellular spaces or in the submucosa. Particles apparently did not penetrate the intercellular spaces of the epithelium beyond the level of the tight junction. (auth)

27932 EFFECTS OF FEEDING PRACTICES ON ^{137}Cs LEVELS OF MILK. Gerald M. Ward, H. F. Stewart, and James E. Johnson (Colorado State Univ., Fort Collins). J. Dairy Sci., 48: 38-43(Jan. 1965).

The ^{137}Cs levels from fallout of various feeds fed to the University-dairy herd for the past 3 yr were determined, illustrating the variations of resulting milk values which can be produced by feeding practices. The data indicate that feeding practices can account for large variations in milk levels under conditions of the same fallout rate. The pasture studied consisted of ten acres of irrigated grass-alfalfa divided into three sections for rotational grazing. The highest levels of ^{137}Cs were found in pasture forage over short periods of time following contamination by rains of high activity. Maximum pasture activity was found in June, with consistent declines until the end of the pasture season. Maximum values were 1962, 5200; 1963, 6800; and 1964, 4100 pC/kg of dry matter. Nearly as much activity was found in first-cutting hay, with a four-fold decrease in third-cutting hay. Corn silage had slightly higher ^{137}Cs values than third-cutting hay, whereas grain mixes were considerably lower than third-cutting hay. Milk from cows fed solely on pasture is a reliable indicator of variations in the fallout of ^{137}Cs. However, under the more common dairy feeding practices, where cows are not entirely on pastures, milk levels are not closely related to fallout rates, even in the summer months. Milk and dairy products supply about 60% of the ^{137}Cs in the diet of the average U.S. adult, but these levels are not considered a serious hazard to human health. The highest levels encountered in this study were 200 pC/l, whereas 20,000 pC/l is suggested as the maximum permissible concentration by the International Commission for Radiological Protection. (BBB)

27933 STUDIES ON THE METABOLISM OF MAGNESIUM IN THE MAGNESIUM-DEFICIENT RAT. Jerry G. Chutkow (Univ. of Chicago). J. Lab. Clin. Med., 65: 912-26(June 1965).

The absorption, excretion, and tissue distribution of magnesium-28 were studied in young rats fed a diet low in magnesium. Symptomatic magnesium deficiency was accompanied by hypomagnesemia; by hypophosphatemia that could be rectified by realimentation with magnesium; by continued fecal and negligible urinary excretion of ^{28}Mg; and by an increased absorption that was not due to hypomagnesemia per se and that was reversible initially but not later by large amounts of magnesium administered by gavage. In normal rats, bone, kidney, heart, and liver took up ^{28}Mg rapidly, and exchangeable magnesium appeared to be in at least two forms, one of which turned over at a faster rate than the other. Brain, muscle, and testicle took up ^{28}Mg more slowly and lacked the more labile phase. The radioisotope was diverted from bone to the soft tissues in the hypomagnesemic animals. (auth)

27934 TRIIODOTHYRONINE (^{131}I) SPONGE RESIN UPTAKE VALUES IN MAN AND SHEEP. Merton A. Quaife and Samuel Mason (Air Force Weapons Lab., Kirtland AFB, N. Mex.). J. Nucl. Med., 6: 192-5(Mar. 1965).

Normal resin impregnated sponge T-3 uptake studies were carried out in two mammalian species. Duplicate samples from 57 sheep (Ovis aries) had a mean value of 29.7 ± 3.7% (SD) and a standard error of the mean of 0.5%. Eighty-five duplicate determinations in human subjects revealed a mean uptake value of 29.4 ± 3.2% (SD) with SE 2%. It is suggested that this finding is an additional parameter enhancing the value of Ovis aries in an interspecies correlation of the biological effects of ionizing radiation. (auth)

27935 INTERNAL DOSIMETRY STUDIES OF RADIOPHARMACEUTICALS. II. SODIUM IODOHIPPURATE ^{131}I. Jonathan P. Miller, Ann Dalziel, and L. E. Michael Crawford (Abbott Labs., North Chicago and Oak Ridge National Lab., Tenn.). J. Nucl. Med., 6: 196-204(Mar. 1965).

The distribution and effective half-life of sodium iodohippurate ^{131}I was studied in both rats and cats. The data were extrapolated to man to estimate the radiation dose delivered during diagnostic use for determination of renal function. Radiation dosage calculations indicate that the radiation hazard from a 30 μC dose of sodium iodohippurate ^{131}I would be minimal, and that this dose would deliver less radiation than suggested weekly exposure limits to radiation workers. (auth)

27936 LABELED PLASMA LIPIDS AFTER INGESTION OF RADIOACTIVE FATS. J. C. Sisson (Veterans Administration Hospital, Ann Arbor, Mich. and Univ. of Michigan, Ann Arbor). J. Nucl. Med., 6: 210-19(Mar. 1965).

Work on incorporation of ingested labeled-fat into the individual fractions of plasma lipids and plasma lipoproteins is reported. In selected subjects, the plasma levels of lipid-^{131}I were compared with those of lipid-^{14}C attained after the simultaneous administration of triolein-^{131}I and tripalmitin–carboxy–^{14}C or tristeorin–carboxy–^{14}C. None of the patients had values outside the normal range for the basic fat-^{131}I tolerance test and triglycerides. Radioactivity in the plasma triglycerides constituted 90% of the trichloroacetic acid (TCA) activity. Ultracentrifugal separation of lipoprotein fractions revealed that most of the radioactivity resided in the chylomicrons and very low density fractions. Partition of radioactivity among the lipoprotein fractions was similar in all patients. Tripalmitin-^{14}C was associated with higher radioactivity levels in plasma triglycerides than was triolein-^{131}I, which was given simultaneously. Plasma ^{14}C radioactivity was greater than that of ^{131}I in all lipid fractions studied when tripalmitin was the ^{14}C triglyceride. However, plasma radioactivities after tristearin-^{14}C ingestion closely approximated the activity levels of simultaneously administered triolein-^{131}I. Distribution patterns were similar both for lipoprotein-^{131}I and lipoprotein-^{14}C. (H.G.D.)

27937 THE TOXICITY OF BERYLLIUM SULFATE ON THE ISOLATED LUNG OF THE GUINEA PIG. Pham-Huu-Chanh (Centre de Recherches sur les Toxicites, Toulouse). Med. Exptl., 11: 202-6(1964).

The activity of $BeSO_4$ in the lungs was studied by means of the isolated guinea pig lung technique, using an artificial thorax to maintain lung survival. Under the experimental conditions used, $BeSO_4$ administered as aerosols and injected into the pulmonary artery is toxic for the lung; it causes severe lung spasms which may completely interfere with respiratory movement. The origin of the lung spasm is in the bronchi and the alveoli. It was possible

to neutralize its action with Aerolone, oxyphenyloxyethylaminoethane, and adrenaline aerosols, but only the Aerolone aerosols protected the lungs indefinitely from later administrations of $BeSO_4$. No conclusions were drawn regarding the action of $BeSO_4$ on other organs connected with respiratory function nor on the particular affinity of Be for the lungs, but it is concluded that the lungs are sensitive to the action of this metal and that the local action of Be on the lungs constitutes one of the fundamental elements in the symptomatology of Be poisoning. (BBB)

27938 CONVERSION OF TRYPTOPHAN TO INDOLEACETAMIDE AND FURTHER CONVERSION TO INDOLEACETIC ACID BY PLANT PREPARATIONS. V. M. Riddle and Mendel Mazelis (Univ. of California, Davis). Plant Physiol., 40: 481-4(May 1965).

Horse-radish peroxidase and cabbage preparations with peroxidase activity catalyze the oxidative decarboxylation of tryptophan to indoleacetamide. Pyridoxal-5′-phosphate and Mn^{2+} are required cofactors in this conversion. The further conversion of indoleacetamide to indoleacetic acid can be demonstrated in cabbage seedlings and cabbage seedling homogenates. If the homogenates are dialyzed, there is a complete loss of amidase activity. No indoleacetamide could be detected after feeding DL-tryptophan-3-^{14}C to cabbage seedlings. Cabbage seedling homogenates contained potent inhibitors of the decarboxylation reaction which were removed by dialysis. An explanation is advanced as to how these observations would explain the lack of indoleacetamide formation in vivo. Small amounts of free indoleacetic acid are formed from tryptophan during the decarboxylation even when purified horse-radish peroxidase is the enzyme used. There is no reaction between free indoleacetamide and horse-radish peroxidase in the presence of pyridoxal-5′-phosphate and Mn^{2+}. (auth)

27939 COMPARISON OF ^{95}Zr AND ^{95}Nb DISTRIBUTIONS IN MATERNAL AND FETAL RABBIT TISSUES. Norman S. MacDonald, Raymond Hamel, Marilyn Hepler, and Ellin James (Univ. of California, Los Angeles). Proc. Soc. Exptl. Biol. Med., 119: 148-50(May 1965).

Five pregnant Dutch rabbits were given intravenous injections of $^{95}Zr-^{95}Nb$ as oxalates in normal saline solution. Twenty-four hours later each was killed, and the concentrations of $^{95}Zr-^{95}Nb$ determined in ashed tissues. Mean concentrations for each isotope are tabulated for the following fetal and maternal tissues: muscle, liver, kidney, tibia head, tibia shaft, and placenta. (H.G.D.)

27940 A PROPOSED MECHANISM FOR THE UPTAKE OF RADIOACTIVE TRACERS BY AN IN VITRO HYDROXYAPATITE SYSTEM. David N. Edgington (Argonne National Lab., Ill.). Radiation Res., 25: 257-68(June 1965).

Several mechanisms have been proposed to describe the uptake of radioactive tracers by hydroxyapatite (synthetic bone) in vitro, namely, ion exchange, diffusion, and recrystallization or aging. Earlier workers favored a series of three first-order ion exchange reactions as the most likely mechanism; but when experiments were continued for an extended period, the calculated values were less than those observed. The case for recrystallization is considered in detail. The rate equation for recrystallization was derived from the equations for crystal growth by assuming that the overall change in the surface area of the crystal is small. On integration of the rate equation a power function is obtained: $(1 - \alpha) = [(t + \gamma)/\gamma]^{-b}$, where $(1 - \alpha)$ is the fraction of tracer remaining in solution at time t; γ is a constant; $b = 1/(n - 1)$; and n is the order of the reaction. The uptake results for radioactive calcium, radium, phosphate, and yttrium were re-examined, and they can be described, over the whole time range studied, by a single power function, with n = 10 for the calcium and radium, 7.3 for phosphate, and 3.4 for yttrium. The values of n are closely related to the number of ions of interest in the unit cell; that is, for hydroxyapatite, $Ca_{10}(PO_4)_6(OH)_2$, n = 10 for Ca and 6 for PO_4^{3-}. (auth)

27941 A THEORY OF THE KINETICS OF ALKALINE EARTH AND TRACER METABOLISM. Richard B. Holtzman (Argonne National Lab., Ill.). Radiation Res., 25: 277-94(June 1965).

The fractional retention, R, of a single injection of an alkaline earth tracer in man and animals may be described empirically by a relatively simple power function with only two adjustable constants, namely: $R = (t + \gamma/\gamma)^{-b}$, where t is the time after injection, and b and γ are constants. It is suggested here that the principles of reaction kinetics provide a theoretical basis for this equation and also a quantitative method for correlating calcium metabolism with that of its tracers. The function above is shown to result from a nth-order kinetic equation, if it is assumed that the tracer is deposited in a purely inorganic system of bone crystals (hydroxyapatite) of constant mass. The concentration of calcium in the surrounding solution is also assumed to be constant. This function applies to gross calcium metabolism, but it also applies to tracers if the specific activity of the gross calcium deposited with the tracer at t = 0 remains constant; that is, the tracer cannot mix with the other calcium in the system. The constants are then $b = 1/n$ and $\gamma = c_0^{-1/b}$ (b/k), where (n + 1) is the order of the reaction, k is a rate constant, and c_0 is the ratio (at t = 0) of the calcium deposited with the tracer to that already present in the system. The proposed mechanism corresponds to that of recrystallization, with only the dissolution component of the reaction being observed. A modification of this method to describe the case of continuous uptake of the tracer at a constant rate predicts only a limited accumulation of tracer at long times. The theory is consistent with the following experimental data: (1) that R is independent of the amount of tracer injected; (2) that R is dependent on the gross material (calcium) in the diet; and (3) that the b of ^{45}Ca retention (but not that of ^{90}Sr) varies with the calcium content of the diet (the variations are only apparent and γ is the actual variable). (auth)

27942 ANALYSIS OF THE DISAPPEARANCE OF S^{35} FROM THE BLOOD OF MEN, RATS, AND MICE. Raymond G. Gottschalk, Phyllis O. Miller, and Henry H. Grantham, Jr. (George Washington Univ., Washington, D. C. and Veterans Administration Center, Martinsburg, W. Va.). Radiation Res., 25: 295-308(June 1965).

The blood levels of ^{35}S in six men, twelve rats, and fifty-four mice were analyzed after intravenous or intraperitoneal injections of $Na_2{}^{35}SO_4$. The time intervals studied were from 2 minutes to 12 days for men, from 4 hours to 6 days for rats, and from 1 minute to 65 days for mice. At 1 minute after intravenous injection the mice had an ^{35}S level of 250%, and at 15 minutes after intraperitoneal injection a maximum of 155%. Thirty minutes after injection both the IV and IP groups were at the same level of 125%. An intravenous injection to a man gave at 2 minutes an ^{35}S blood level of 520%. The data were fitted by sums of exponentials with the aid of the NIH-OMR 9B19 and 9B21 computer programs. The presentation as sums of exponentials required at least three descending exponentials, and extended data show that at least four descending exponentials gave a better approximation of the observed characteristics as the blood level–time course. The λ's were similar for the three species studied, but the σ's were larger for the men. The areas under the fitted curves are a measure of radiation received by the blood, and they indicate that the blood of the men received a dose four times that of the mice. (auth)

27943 EFFECTS OF CALCIUM, MAGNESIUM, PHOSPHORUS, AND FAT ON ^{90}Sr ASSIMILATION IN THE RAT. Z. V. Dubrovina, P. M. Malkin, and L. P. Andreeva. Radiobiologiya, 5: 183-5(1965). (In Russian)

In 22-day experiments with white rats, increasing the Mg, P, and fat contents of the diet decreased the accumulation of ^{90}Sr. The effect was indirect, being accomplished by action through the calcium. Protein and phytin compounds in the diet also affected strontium accumulation. (IIC-M.G.)

27944 INFLUENCE OF INDOLYLALKYLAMINES AND OF SOME OTHER COMPOUNDS ON THE RESISTANCE OF

MICE TO LOW BAROMETRIC PRESSURE. P. G. Zherebchenko. Radiobiologiya, 5: 285-6(1965). (In Russian)

Five radioprotective compounds (indolylalkyl and mercaptoalkyl amines) in protective doses affected the sensitivity of female white mice to hypoxia resulting from low barometric pressure. The effect differed in degree. The decrease in pressure apparently contributed to the development of hypoxia resulting from administration of the compounds. (IIC-M.G.)

27945 AERATION UNDER PRESSURE AND THE QUESTION OF FREE RADICALS. C. G. Heden and A. S. Malmborg (Karolinski Institutet, Stockholm). Sci. Rept. Ist. Super. Sanita, 1: 213-21(1961).

The effects of culture under high pressure on bacteria were investigated and the results, which appeared to implicate effects of O_2 and free radicals, were interpreted in terms of earlier findings of radioinduced injury by similar mechanism. In a specially designed vessel, Escherichia coli and Staphylococcus aureus were grown under pressures up to 65 kg/cm^2. Already after 3 hr there was a slight retardation of growth as compared to controls growing at atmospheric pressure in identical tubes. Basically the same results were obtained with both species, but E. coli grew faster and a retardation could be observed earlier. The retardation was more pronounced at higher pressure levels and higher frequencies of decompression. Pressure levels above 10 kg/cm^2 reduced the increase in turbidity of the cells. From the growth curve plotted it appeared that the cells can divide only once. However, they do not seem to be injured because growth is resumed after a normal time lag as soon as the pressure is released. At the highest pressure level (65 kg/cm^2) the cells tended to agglutinate but at 60 kg/cm^2 they could still be counted. The results of these experiments with active aeration are explained by a toxic oxygen effect. This may increase the oxidation-reduction potential to such a level that the reducing capacity of the bacteria is insufficient to depress it to the level necessary for growth. There is evidence that enzymatically activated hydrogen reacts directly with the oxygen under pressure, yielding hydrogen peroxide which, in turn, raises the catalase production above normal. It is likely that certain oxidative enzyme systems exposed to oxygen under pressure yield the same free radicals (OH and HO_2) that occur in water exposed to ionizing radiation. (BBB)

27946 EFFECTS OF VARIOUS CATIONS ON CESIUM UPTAKE FROM SOILS AND CLAY SUSPENSIONS. W. A. Jackson, Doris Craig, and Hector M. Lugo (North Carolina State Univ., Raleigh). Soil Sci., 99: 345-53 (May 1965).

The effects of added salts on plant uptake of ^{137}Cs from soils and clay suspensions were examined. For the soils used, NH_4 was more effective than K, but less effective than Rb, in maintaining ^{137}Cs in solution. Potassium reduced ^{137}Cs uptake and NH_4 increased it. The effect of Rb was variable; ^{137}Cs uptake increased sharply at lower Rb concentrations but at higher concentrations it was restricted. The data suggest net ^{137}Cs uptake resulted from a combination of the effects of the added cations on maintaining ^{137}Cs in solution and their effects on inhibition of uptake and transport processes by the plants, NH_4 being less effective than K or Rb in the latter. Experiments with Utah bentonite suspensions for shorter time periods support the observations with the soil systems. (auth)

Radiation Effects

Refer also to abstracts 27979 and 28548.

27947 (TID-20745) IRRADIATION OF HYPOTHALAMIC REWARD SUBSTRATE IN RAT. Final Report. James Olds and Marianne E. Olds (Michigan Univ., Ann Arbor. Dept. of Psychology). Apr. 1964. Contract AT (11-1)-953. 36p. (ORA-04289-3F). Dep.(mn); $2.00(cy), 1(mn) CFSTI.

Temporary excitatory effects followed by circumscribed lesions reflected in reduced responsiveness and histological damage were produced in subcortical reward and punishment centers by a chronic irradiation probe implanted to permit administration of repeated and controlled doses at a chronic electric stimulation site in rat brain. Both functional excitation and debilitation were produced when local irradiation doses were at a rate high enough to produce evident histological damage in a 6-hour period but neither appeared regularly when lesser doses were used. The excitation appeared mainly during irradiation; the functional debilitation appeared one to several days thereafter. Once the cold probe was implanted irradiation could be applied repeatedly in a highly focal manner without further surgery. This was viewed as possibly suggesting a new method of irradiation or lesion therapy and as having further value in animal research. (auth)

27948 (TID-21862) PERSISTENT RADIATION-INDUCED CHROMOSOMAL CHANGES IN NATIVE POCKET MOUSE POPULATIONS OF THE NEVADA TEST SITE. Summary Report, April 18, 1964–April 18, 1965. Joseph W. Towner and Robert G. Lindberg (Northrop Space Labs., Hawthorne, Calif.). Contract AT(04-3)-510. 17p. (NSL-64-136-1). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Preliminary results are reported from a study of chromosome aberrations in a population of the long-tailed pocket mouse (Perognathus formosus) at the Nevada Test Site. Somatic or germinal tissues from 158 animals were sampled and more than 3000 chromosome preparations of mitosis and meiosis were accumulated for study of gross structural and numerical aberrations. An attempt was made to distinguish between those chromosome aberrations that might persist in the population by gametic transmission in successive generations and those aberrations acquired by the individual or transitory on the population level. The effects of exposure of the population to chronic radiation from fallout on chromosome aberrations will be evaluated. (C.H.)

27949 (TID-21889) RADIATION DOSE-RESPONSE RELATIONSHIPS BASED ON NEUTRON-INDUCED HEMATOLOGIC CHANGES IN RATS (thesis). Donald Gillmor Willhoit (Pittsburgh Univ., Pa.). 1964. Contract AT(30-1)-913. 203p. Dep.(mn); $6.00(cy), 4(mn) CFSTI.

Adult male Sprague-Dawley rats were exposed to ten neutron radiation doses ranging from 22 to 2350 rads. The doses, expressed as first collision doses and including a ten per cent gamma dose contribution, were delivered at a dose rate of approximately 105 rads per minute. Hematologic changes were studied for a period of four months post-irradiation. The evaluation of the radiation-induced hematologic changes and their relationship to the pre-irradiation baseline values and concurrent control group values led to the selection of "per cent of control" as the normalized expression of response. Dose-response relationships of time-specific responses were examined but were found to be less useful for delineating different dose groups than expressions utilizing both magnitude and duration of response. Cumulative response scores, integration of responses with respect to time, were evaluated in terms of characteristic responses to radiation. The cumulative response scores of each of these characteristic responses, initial rise, depression and recovery overshoot, were found to depend on dose level and the parameter studied. The area of depression was the most dose-specific finding following radiation exposure. This expression alone appeared most suitable for platelets. The response of the erythrocytic indices was best described by a measure of the initial rise and the subsequent depression. Lymphocyte response is best described by the area of depression and the recovery overshoot area. Several expressions of neutrophil response were examined, but due to the great diversity of individual response, no suitable expression was found. The significance of these findings to human neutron exposures is not clear and extrapolation would require a knowledge of relative intestinal sensitivity to neutrons; relative sensitivity of blood cell precursors; comparative lifespan of blood cells; and

importance of dose distribution factors in hematologic injury. From the results of this research it was concluded that the changes in the peripheral blood of rats following short-term neutron irradiation followed characteristic response patterns; the magnitude and duration of these changes were generally related to the magnitude of the neutron dose and as the time after irradiation increased the time-response relationships became more definitive up to about day twenty; the integration, with respect to time, of the magnitude of the response provided better dose specificity than expressions of time-specific response; the mean from the combination of the individual dose estimates based on platelets, erythroid indices, and lymphocytes yielded greater dose specificity than any one of these parameters alone; and early changes in the erythroid indices and lymphocytes, in combination, provided a basis for a first approximation of prognosis, i.e., whether an individual exposure was in the lethal or sublethal range. (144 references.) (C.H.)

27950 (UCD-472-111) LONG-TERM EFFECTS OF X RADIATION ON THE BEAGLE. Annual Progress Report No. 14. A. C. Andersen (California Univ., Davis. School of Veterinary Medicine). Apr. 1965. Contract AT(04-3)-472. 143p. Dep.; $4.00(cy), 3(mn) CFSTI.

Data are summarized on the clinical status of 154 Beagles exposed to single or fractionated doses of whole-body x radiation in 1954. The average age of the dogs is now 10.7 yr. Approximately 50% of the colony has one or more mammary tumors, but no case of leukemia has been found. Data are included from a cardiovascular survey of aging Beagles and a study of reproductive fitness in female dogs. A single whole-body exposure 280 rad x radiation at 7 days, 87 days, or 9 months of age had little effect on the reproductive fitness of females but fractionated doses totalling 750 rads, given at weekly intervals of 50 rad, caused partial or complete sterility. Losses since the experiment began in 1952 total 57%, with 75 out of 200 deaths due to neoplasms. Autopsy findings are summarized for 48 dogs. (C.H.)

27951 (FTD-TT-65-53) IMPORTANCE OF ORTHOSTATIC DISTURBANCE IN RABBITS SUBJECTED TO TOTAL X-RAY RADIATION. P. V. Sipovskii (Sipovskiy) and L. V. Funshteyn. Translated from Med. Radiol., 4: No. 3, 80-1(1959). 4p. CFSTI.

Functional disturbances of the cardiovascular system in irradiated animals were studied in rabbits treated orthostatically either prior to or following exposure to various doses of x radiation. Survival rates fell sharply in rabbits irradiated prior to being placed in the orthostatic position for three hours. However, no noticeable change in lifespans was found in rabbits irradiated after 3 hrs in an orthostatic position. It is concluded that orthostatic disturbances and irradiation act synergistically to bring about the occurrence of early death in the former group. (H.G.D.)

27952 (OTS-63-11455/3-4(p.111-16)) THE INCORPORATION OF ADENINE-^{14}C INTO THE DNA OF X-IRRADIATED BACTERIA. S. Stavric, B. Miletic, and M. Drakulic. Translated from Arhiv Biol. Nauka (Belgrade), 15: No. 3-4, 199-205(1963).

By the analysis of the incorporation of ^{14}C-adenine into the DNA of irradiated bacteria and the comparative analysis of their DNA biosynthesis, it was established that immediately after irradiation one part of the DNA degrades and simultaneously a somewhat weaker process of DNA synthesis takes place. The specific activity of DNA of irradiated bacteria, to which ^{14}C-adenine was added immediately after irradiation, is considerably lower than that of nonirradiated bacteria, even in the phase when the rate of DNA synthesis in irradiated bacteria is very close to that of DNA synthesis in nonirradiated bacteria. A complete explanation of this phenomenon was not found. (auth)

27953 AMINO ACIDS IN THE BLOOD IN ACUTE RADIATION INJURY. M. Podiltschak, L. Kuzmenko, D. Makar, E. Jurmin, W. Tschepowski, and W. Pobjegailo. Acta Biol. Med. Ger., 12: 137-46(1964). (In Russian)

Eleven amino acids in serum were followed by chromatography in the blood of lethally irradiated rabbits one to 60 hr postirradiation. The rabbits, weighing about 2400 g were exposed to 800- or 1100-R, whole-body doses of 180-kv x rays in groups of 10. The authors studied the changes of the amino-acid content in the blood plasma. In the course of the resulting radiation disease several amino acids, especially lysine and cystine, were increased 2- to 3-fold, as compared to the controls. The increase of some other amino acids, such as histidine, arginine, methionine, and valine, was less marked. At the peak of the radiation disease the increase of these amino acids was not pronounced. At the same time, a slight decrease of tyrosine and phenylalanine was observed during the acute radiation disease. It is suggested that the increase of most of these amino acids in the blood is due to a deficiency of protein and of the negative nitrogen balance of the irradiated animal as a result of a catabolism of proteins in some organs and tissues, whereby amino acids in the blood are increased. (BBB)

27954 HOW MANY DIFFERENT VIRUSES CAUSING LEUKEMIA IN MICE? Ludwik Gross (Veterans Administration Hospital, Bronx, N. Y.). Acta Haematol., 32: 44-62(July 1964).

From a survey of previously published and new data, it is suggested that a single virus, which is here designated mouse leukemia virus type A, is responsible for the induction of various forms of leukemia and lymphomas in mice. Most of the leukemic viruses recently isolated in mice from a variety of sources, such as from spontaneous leukemia, from radiation-induced leukemia, or from different transplanted mouse tumors, may represent isolations from different sources of the same leukemic virus, i.e., of the mouse leukemia virus type A, or some of its close variants. The virus strain isolated from radiation-induced leukemia is described. A filterable leukemogenic agent isolated from radiation-induced mouse leukemia, and designated passage X, has now been passed through suckling mice of either C3H(f) or C57 Brown/cd strains, inducing leukemia in most of the inoculated animals after an average latency varying from 5 to 8.5 months. In its more recent 13th to 16th consecutive cell-free passage through suckling C3H(f) mice, this virus strain induced leukemia, mostly of the lymphatic form, in 54 out of 62 inoculated mice (87%) at an average age of 7 months. Leukemia induced in mice with the passage X virus strain was indistinguishable from that induced under similar experimental conditions with the passage A virus, found in certain inbred strains of mice developing leukemia spontaneously. Preliminary electron microscopic studies of organs of mice that developed leukemia as a result of inoculation of the passage X virus strain, revealed the presence of spherical particles identical in size, morphology, and location with those of the passage A virus. It is stressed that the mouse leukemia virus, even though isolated from different sources, has identical physical properties. The virus is a spherical particle about 100 mμ in dia, and is found in the cytoplasm or in the intercellular spaces, of virus-infected cells. The leukemic filtrates containing the virus particles are thermolabile and ether-sensitive. The different leukemogenic virus strains isolated from a variety of sources induce in mice morphologically the same disease. It is possible that there are slight antigenic differences between some of the variant strains of the mouse leukemia virus, but such differences would not necessarily imply that the isolated strains represent distinct viruses. (BBB)

27955 EARLY HEMATOLOGIC EFFECTS OF WHOLE-BODY 14-Mev NEUTRON IRRADIATION IN MICE. M. L. Davis, E. B. Darden, Jr., and G. E. Cosgrove (Oak Ridge National Lab., Tenn.). Acta Radiol., Therapy, Phys., Biol. (N.S.), 3: 87-95(Apr. 1965).

Mice were exposed to 50 to 400 Rad of 14 Mev neutrons or 100 to 400 Rad of roentgen rays. Determination of total and differential leukocytes and hematocrit values were

made. A correlation of leukopenia to roentgen dose was observed and reached a maximum within 1 to 3 days. Recovery occurred in 6 to 20 days in all parameters excepting the lymphocyte counts. The RBE of 14 Mev neutrons under the experimental conditions appeared to approximate that of the used roentgen rays for the parameter studied. (auth)

27956 DELAYED CHANGES IN THE GROWING ORGANISM FOLLOWING SMALL RADIATION DOSES. Vl. Stasek, J. Jaboubkova, J. Kolar, K. Brachfeld, St. Tichy, M. Lokajicek, and Vl. Maly (Charles Univ., Prague). Acta Radiol., Therapy, Phys., Biol. (N.S.), 3: 96-108(Apr. 1965).

A group of 77 subjects irradiated in early childhood for benign conditions were examined 10 to 15 years later, a group of 106 patients acting as a control. In view of the fact that the difference between the frequency of tissue and organ changes and systemic disorders in the irradiated group and that of the control group was statistically significant or very significant, it is assumed that radiation acted as an important pathogenic factor. (auth)

27957 LONG-TERM EVALUATION OF MILD GASTRIC IRRADIATION AS ADJUNCTIVE THERAPY. Joseph B. Kirsner (Univ. of Chicago). Am. J. Digest. Diseases, 9: 726-8(Oct. 1964).

The effect of ionizing irradiation on gastric secretory activity was studied with reference to 1485 patients treated for peptic ulcer, and possible late carcinogenic effects of the treatment are analyzed. The purpose of gastric irradiation is to decrease or completely suppress the production of HCl by the destruction of parietal cells. Therapeutic benefits derived from irradiation relate solely to its effect upon gastric secretion. The total depth dose employed was about 1600 R, delivered over a period of 10 days and in divided daily applications to the fundus and body of the stomach through anterior and posterior portals. Usually one course of gastric irradiation was administered to the patient, although in earlier years a second course was utilized occasionally, permitting the cure of patients who otherwise might have required surgery. Achlorhydria was judged in the 1485 patients by response to standard histamine or Histalog procedure. Eighty-seven patients (6%) developed achlorhydria for six months or less, 61 patients (4%) for two years or longer, so that achlorhydria occurred in 10% of the total series. Decreases in acid production, lasting for one year or more, were divided into categories as follows: 50% decrease occurred in 30% of patients. The rate of recurrence of peptic ulcer within five years was used as the ultimate index of the therapeutic effect. Among more than 1000 male patients with duodenal ulcer, the recurrence rate was 32%; among 230 females, 25%. For gastric ulcer, the rate of recurrence was 29 and 14%, respectively. These figures are much lower than recurrence rates after conventional therapy, which usually range between 80 to 90%. Since the antisecretory effects of gastric irradiation are not permanent in most patients, the rate of recurrence of peptic ulcer in the irradiated group may increase when acid secretion returns. Also considered is the possible relation of the gastric irradiation to subsequent neoplasia. The over-all incidence of neoplasm in the irradiated group of patients did not differ from that in a control group. The incidence of gastric cancer appeared to be lower than usual, while the incidence of carcinoma of the pancreas and lungs had increased. Carcinoma of the lung occurred more often on the right than on the left (the side of irradiation). These trends reflect recent general trends in the incidence of carcinoma, emphasizing substantial increases in the incidence of carcinoma of the lung and of the pancreas. The leukemia rate in this series was not increased. Thus, while the question of neoplasmia resulting from gastric irradiation is not settled, there does not appear to have been a significant increase in the number of malignant tumors after mild irradiation during the period of observation (from 1937 to present). (BBB)

27958 SECRETORY COMPARISON OF GASTRIC FREEZING AND RADIATION THERAPY. Sukran Karacadag and Arthur P. Klotz (Univ. of Kansas Medical Center, Kansas City). Am. J. Gastroenterol., 42: 604-10 (Dec. 1964).

The relative abilities of ionizing irradiation and freezing techniques to reduce gastric acid secretion were studied in 44 patients. Gastric freezing to reduce gastric acidity was introduced as a new treatment for ulcer with highly favorable initial reports, but later indicated that gastric secretory changes and clinical improvement are only temporary. Radiation treatment, another form of ulcer therapy that has been used, in principle suppresses gastric acid secretion by destruction of parietal cells. Decreased secretion may then persist for varying periods of time. In most cases gastric acidity returns to previous levels, but this takes a considerably longer period of time when compared with freezing. The technic of irradiation employed 1800 R of orthovoltage x rays in 10 divided doses. Four other patients were given 2000-R ^{60}Co γ radiation in 10 divided doses. Histologic gastric secretory studies were performed before treatment and at three weeks and three months after radiation therapy. A moderate decrease in volume and free HCl acid was observed 24 hr after gastric freezing. Three weeks later volume and acid had returned to prefreeze levels and remained there as shown by the three-month gastric analysis. In gastric biopsies no significant changes attributable to freezing were found. A marked decrease in volume and free HCl was observed three weeks after radiation therapy in basal and histamine-stimulated fractions. At three months the gastric analyses still showed a significant decrease in volume and acidity. Biopsies performed on the tenth day of irradiation demonstrated distortion of parietal and chief cells. Parietal cells were undergoing vacuolization with considerable loss of cytoplasmic substance. Interstitial tissues were infiltrated with round cells. Three weeks after irradiation, gastric biopsies showed similar mucosal changes and an increase of round cell infiltration. At three months two patients showed extensive loss of glandular substance and chronic inflammatory infiltration of interstitial tissue. Thus the effects of freezing and radiation on the gastric mucosa are quite different. Freezing most probably results in a temporary partial vagotomy, whereas radiation results in direct damage to the gastric mucosa, as shown by gastric biopsy. Comparative studies show that clinical results from radiation are far superior to freezing where a recurrence of ulcer in 82 of 100 patients within nine months was encountered. An additional finding was the safety of the radiation procedure. Aside from transitory moderate nausea and tanning of the skin over the radiation portals, no side-effects occurred. On the other hand, massive hemorrhage, development of gastric ulcer, and pyloric obstruction have occurred in some patients who had gastric freezing. (BBB)

27959 AMYLOIDOSIS IN C3H MICE TREATED WITH GOITROGENS. Carmen B. Casas and Roberto Buso (Univ. of Puerto Rico, San Juan). Am. J. Pathol., 45: 645-51 (Oct. 1964).

C3H mice of both sexes, castrated at the age of one month and treated with thiouracil (TU) or propylthiouracil (PTU) or given injections of ^{131}I, developed amyloid deposition in the kidney, spleen, liver, and thyroid gland in a high percentage of animals. The same results were obtained in the noncastrated mice similarly treated. The mice underwent gonadectomy at the age of one month and were then continuously fed either 0.3% TU or 0.03% PTU. Another group of castrates was given injections of a thyroid-destructive dose of ^{131}I. They were allowed to survive as long as possible. Amyloid deposits, observed in hematoxylin and eosin-stained preparations and confirmed by the special strains, were found in 75% or more of the C3H mice treated with the goitrogens TU and PTU and in animals whose thyroids were destroyed by irradiation. Removal of PTU from the diet after 12 months of feeding was followed by reversal of the thyroid hyperplasia but not by disappearance of the amyloid degeneration a month after withdrawal of the goitrogen from the food. An important finding was that the animals given injections

of ^{131}I developed large pituitary tumors. Those treated with TU or PTU did not show such tumors. The pituitary neoplasms were chromophobe, also termed thyrotrophe tumors because they produce thyroid-stimulating hormone as a physiologic response to the absence of the thyroid secretion. The growths became more than half as large as the brain and by pressure caused death in these animals. The absence of this disease in the intact and gonadectomized stock-fed animals strongly points to thyroid suppression as a causative factor. It might also confirm the hypothesis that thyroid-stimulating hormone is the direct cause of this pathologic condition since this pituitary factor is probably augmented in mice given the goitrogens and oversecreted by the thyrotrophe tumors like those found in the group with radiothyroidectomy. It is speculated that primary amyloid disease is a different disease entity from secondary amyloidosis, perhaps with a genetic factor involved related to the phenomenon of aging. These experiments probably concern the secondary form in which hormones, in particular those of the thyroid and anterior hypophysis, are determining factors. Thus, these results relate amyloidosis to depressed thyroid secretion and a consequent increase in circulating thyroid-stimulating hormone. (BBB)

27960 MECHANISM OF RADIORESISTANCE OF BUDDING YEAST. INFLUENCE OF CERTAIN METABOLIC FACTORS. Ethel Moustacchi (Institut Pasteur, Paris). Ann. Inst. Pasteur, 105: 757-73(Oct. 1963). (In French)

The influence of several metabolites on the resistance of five haploid strains of Saccharomyces cerevisiae to x radiation was studied. The yeast cells were irradiated in aerated cultures at 30°C with 37-kv x rays at dose rates of six to 90 kr/min. The radioresistance of budding yeast cells was not affected by phosphorus, uracil, or adenine starvation. The incorporation of 5-fluorouracil had no effect on the radioresistance of these cells. The structure or the processes which are responsible for the radioresistance was not modified by ^{32}P disintegrations. On the contrary, this radioresistance was decreased or disappeared by nitrogen starvation or deprivation of the amino acid corresponding to an auxotrophy of a given strain. The modification of the composition of the free amino acid pool by growing the cells in a lactate medium was also accompanied by a decrease of the radioresistance of the budding cells. This effect was also obtained by incorporating amino acid analogs, such as p-fluorophenylalanine or 5-methyltryptophan. The results indicate that the free amino acid pool and protein synthesis are implicated in the radioresistance of budding yeast cells. However, there is no correlation between RNA synthesis, the free nucleotide pool and this effect. It is postulated that a specific protein may be involved in the division of yeast cells. It is labile, and confers radioresistance by decreasing energy utilization or by favoring restorative processes. (BBB)

27961 THE INFLUENCE OF FRACTIONATED ROENTGEN IRRADIATION ON THE INCORPORATION OF RADIOACTIVE COLLOIDAL GOLD (Au-198) BY THE LATERO-CERVICAL LYMPH NODE OF THE GUINEA PIG. G. Aliprandi, L. Fuoco, C. Jucker, and M. Pesenti (Universita, Milan). Ann. Oto-Laryngol., 80: 887-903(Oct.-Nov. 1963). (In French)

Three groups of four guinea pigs received, respectively, 1000, 2500, and 5000 R of 180-kv x rays over two, five, and ten days. The day after the final injection, 15 μC ^{198}Au was injected in the buccal mucous membrane. After eight hr the animals were sacrificed and the left latero-cervical lymph node removed for a histological study. In the control animals, an autoradiograph showed distribution of the ^{198}Au was irregular. In the lymph nodes which received 1000 R, the reticulo-endothelial cells were moderately hyperplasic and distribution of the gold particles was irregular. After 2500 R, the reduction of the lymphoidal component was evident. The reticulo-endothelial cells were very hyperplasic. Much more ^{198}Au was incorporated in the tissue and distribution was regular. After 5000 R, the reduction of the lymphoidal component was extensive. The gold particles were less regularly distributed, although more were incorporated. The hyperplasia of the reticular system was linked to the destruction of the lymphatic population by irradiation and the resultant elimination of cellular debris. At 5000 R, the increase in total radioactivity was determined by a colloidopexic action facilitated by the fractionated irradiation of the reticular elements. Irradiation acts on the reticulo-endothelial cells and increases their tendency to incorporate particles of Au. (BBB)

27962 RADICAL NECK DISSECTION AFTER IRRADIATION: USE OF TRANSVERSE INCISIONS TO OBTAIN PRIMARY HEALING. Hermes C. Grillo and L. Henry Edmunds, Jr. (Massachusetts General Hospital, Boston). Ann. Surg., 161: 361-4(Mar. 1965).

Healing may fail to occur when radical neck dissection is performed through the usual T or H type of incisions in a field which has been heavily irradiated previously. Consequent necrosis may delay closure, result in salivary fistula, necessitate multiple secondary procedures, and plastic closure, or may result in serious hemmorhage from exposed vessels. To avoid these complications the use of parallel transverse incisions in four previously irradiated patients is described. The patients had received 7000- to 7500-R doses of ^{60}Co γ radiation. Good healing of the incision was obtained in all cases. Transverse incisions are recommended since blood supply may be reduced at the edges and corners of angled skin flaps and cause serious problems in repair of cervical skin if chronic irradiation injury is present. Then necrosis may occur at the angles of flaps and progress to expose the irradiated carotid artery. Complications attributable to irradiation change occur often enough to suggest the need for an approach more conducive to primary healing. Linear incisions avoid the dangerous attenuation of blood supply at points or corners of flaps which result from T or H incisions. Standard radical neck dissection may be performed with the avoidance of such flaps by using parallel transverse incisions. The skin bridge which is created is broadly based at either end and no indication of diminished vascularity in the center was observed. Were healing by secondary intention to occur in one of the transverse incisions, the absence of a vertical limb overlying the carotid artery would be advantageous. These considerations do not apply to the case of planned combined therapy where operation follows irradiation in 4 to 6 weeks and precedes the establishment of late vascular changes. (BBB)

27963 SURVIVAL OF CLOSTRIDIUM BOTULINUM SPORES. A. Anellis, Nicholas Grecz, and D. Berkowitz (Army Natick Lab., Natick, Mass.). Appl. Microbiol., 13: 397-401(May 1965).

Radiation survival curves of spores of Clostridium botulinum strain 33A exhibited an exponential reduction which accounted for most of the population, followed by a tail comprising a very small residual number (7 to 0.7 spores per ml), which resisted death in the range between 3.0 and 9.0 Mrad dose levels. The tail was not caused by protective spore substances released into the suspensions during irradiation, by the presence of accumulated radiation inactivated spores, or by heat shock of pre-irradiated spores. The theoretical number of spore targets which must be inactivated by irradiation was estimated both by a graphical and by a computation method to be about 80, and the D value was calculated to be 0.295 and 0.396 Mrad, respectively, in buffer and in pork pea broth. (auth)

27964 ENDANGERING OF THE NEWBORN CAUSED BY NONINDICATED OR UNNECESSARY MEASURES. Susanne von Berlin-Heimendahl (Univ.-Kinderklinik, Munich). Arch. Kinderheilk., 169: 215-35(Dec. 1963). (In German)

Because of the radiosensitivity of the developing human embryo, it is important to avoid any use of irradiation during the first 4 months of pregnancy as much as possible. Before any woman of child-bearing age is to be treated or studied with x ray, the possibility that she

may be pregnant must be ruled out. As far as is possible, x irradiations should be undertaken only during the first half of the menstrual cycle, so that any incipient pregnancy will not be overlooked. All therapeutic use of x irradiation should be avoided during the fetal period to prevent any chromosomal alterations or somatic mutations, such as postzygotic changes of single characteristics or the total growth capacity of the body cells. One example of an effect of this type is the production of myxedema in fetal thyroids caused by irradiation from radioiodine used for therapy of pregnant women. (BBB)

27965 THE EFFECT OF TELECOBALT IRRADIATION ON THE REGIONAL LYMPHATIC SYSTEM IN MALIGNANT TUMORS IN THE PHARYNGEAL AND LARYNGEAL REGIONS. W. Kley. Arch. Ohren., Nasen., Kehlkopfheilk., 182: 399-403(Dec. 9, 1963). (In German)

The effects of 4000 to 7000 R of telecobalt irradiation and an equal amount of conventional x irradiation on the lymphatic parenchyma were qualitatively similar. The initial response to irradiation was an intense degeneration, which was followed by a regenerative phase as early as four weeks later. The lengths of the degeneration and regeneration phases increased as the focal dose administered was increased. There was never any evidence for blocking of the lymph transport system, either before an administered dose of 6720 R, or when the interval between irradiation and operation amounted to 18 months. The purpose of irradiation of the regional lymphatic drainage system was to destroy malignant tissue sufficiently to prevent further metastases. The storage function of the reticuloendothelial system was retained, but the irradiation initiated an increased lymphatic flow. For the patients this increased the danger that malignant cells that were undamaged or only partially destroyed might be more easily spread to other tissues. This danger should not be overlooked, and to prevent it, each patient should be given cytostatic drugs for at least 10 days, particularly at the beginning of the irradiation. (BBB)

27966 THE EFFECT OF X-RAY IRRADIATION ON THE GROWTH OF THE TEETH AND JAWS IN KITTENS. W. B. Donohue and J. G. Perreault (Univ. of Montreal). Arch. Oral Biol., 9: 739-50(Nov.-Dec. 1964).

The effect of irradiation in moderate doses on the growth of the teeth and jaws was studied in the domestic cat because of the similarity of its dentition to humans, both being of the heterodent, diphyodont type. The change in the rate of growth of the teeth in width and length was studied in four animals by means of vital staining with alizarin red S after a local dose of 2000 R. A comparison of the dimensions of the jaws, as seen in the lateral skull x rays of the irradiated and control animals surviving eight months or more, was made. The findings were as follows: (1) A cessation of the growth in length of dentin, following irradiation. (2) A gradual decrease in the rate of dentin formation in width. (3) Despite a lack of growth in length of the teeth, the teeth nevertheless erupted into the mouth in most cases. (4) A significant reduction in the growth of the jaws in the irradiated animals occurred. This was seen in both the odontogenic and nonodontogenic areas of the jaws. The continued growth of teeth irradiated during the crown-forming stage is probably explained by the influence of the enamel epithelium on the pulpal tissues. Odontoblasts being differentiated or specialized cells tend to be more radioresistant than the less differentiated cells of the proliferative zone of the pulp. It is probable that the decreased rate of growth in width of the dentin is due to a decreased activity of the enzyme systems in the odontoblasts which were functioning prior to the irradiation. Both the interstitial and appositional types of cartilagenous growth at the temporomandibular joint and bone apposition at the temporomandibular joint and along the alveolar crest and surfaces of the jaws continued following irradiation. That the dimensions of the jaws of the irradiated animals were less than that of the control animals may be due either to a decrease in the rate of bone formation, or a premature cessation of the growth of the jaws. However bone apposition occurred following irradiation, as indicated by the alizarin lines in the jaws, and the deposition of osteoid adjacent to erupting teeth. It is therefore likely that the rate of bone deposition rather than the time was decreased. This might be explained by a damping of the enzyme systems of the osteoblasts. (BBB)

27967 HEPATOMEGALY IN HYBRID MICE FROM PARENTAL SPLEEN CELLS. G. O. Bain and J. D. M. Alton (Univ. of Alberta, Edmonton). Arch. Pathol., 78: 633-42(Dec. 1964).

Previous studies showed that in radiation chimeras, hepatomegaly of long duration develops which is attributed to a metabolically compensated disorder. Thus the enlarged liver of the radiation chimera is regarded as a compensatory mechanism to provide essential nutrients to regenerating tissues, since there is evidence for the liver as a source of metabolites for regenerating tissues, especially bone marrow. The long duration of hepatomegaly in radiation chimeras was attributed to tissue proliferation in the graft-vs-host reaction in such animals. The present study concerned histologic changes in the liver after the injection of parental strain, immunologically competent cells into adult F_1 hybrid mice, resulting in a graft-vs-host reaction. During the first two weeks there is enlargement of the spleen, lymph nodes, and liver, then the animals may develop a progressive, fatal, wasting disease. The hepatic reactions were studied in the strain combination (A/J and LAF_1) in which there is no mortality when unconditioned parental donors are used but 83% mortality when parental donors sensitized to F_1 hybrid tissue cells are used. The hepatomegaly which developed in adult F_1 hybrid mice (LAF_1) after the injection of parental strain (A/J) spleen cells was attributable mainly to hypertrophy and hyperplasia of hepatic parenchymal cells. Hypertrophy and hyperplasia of the Kupffer cells may contribute to the increase in liver weight, as may portal infiltration by mononuclear cells and the occurrence of small, focal aggregates of nucleated cells in the lobules. Congestion with red blood cells does not contribute to the hepatomegaly, for the residual erythrocyte content of the enlarged liver was found to be reduced, as shown with ^{59}Fe-labeling experiments. In F_1 hybrids injected with spleen cells from iso-immunized parental strain donors, hepatomegaly was more pronounced and of earlier onset, and a few animals developed focal hepatic necrosis. The results indicate that the etiology of hepatomegaly in secondary disease of radiation chimeras may be more complex than that seen here in F_1 hybrids injected with parental cells. On the hypothesis that the hepatomegaly of the graft-vs-host reaction is a reflection of a metabolically compensated state engendered by the requirements of tissue proliferation, then in F_1 hybrid recipients of parental cells this state is of short duration, for after peak hepatic weight was reached at 11 or 12 days, liver weight rapidly fell to within the normal range. The presence in such livers of basophilic structures with the morphological characteristics of hematoxylin bodies favors an immunopathological etiology. (BBB)

27968 THE ACTION OF X RAYS ON THE ELECTRICAL ACTIVITY OF CHICKEN EMBRYO HEART. G. Le Douarin (College de France, Paris). Arch. Sci. Physiol., 16: 457-66(1962). (In French)

Four and a half-day-old chicken embryos were explanted in an organ type culture. The electrical activity was recorded through two platinum electrodes placed either both on the heart, or one on the heart and one in the culture medium. The embryo hearts received one dose of 10,000 R x radiation. During the first four hr following irradiation there was no clear difference in the rate of heartbeat between the controls and the irradiated chickens, although some of the explants had periods of tachycardia. The amplitude of deflection decreased rapidly during the hr following irradiation, falling from a high of 7.2 mv to 1.8 mv. It increased again slowly, reaching 4.5 mv four hr after irradiation. On the electrocardiogram, the isoelectric space was progressively reduced, finally being replaced by the spreading out of the slow wave. The slow wave often showed an increase in voltage. The amplitude of the fast wave de-

creased. All of these phenomena were at least partially reversible. The amplitude of deflection reached a maximum of 19 mv 24 hr after exposure. It then decreased, falling within normal limits by the third day. After the first day following irradiation, the electrocardiogram showed only a large diphasic wave. Irradiation of the embryo heart modified the cellular physiology, resulting in aberrations of the functioning. Several days after the irradiation the radiolesions led to necrosis. (BBB)

27969 FREE RADICAL CONCENTRATION IN IRRADIATED BACTERIAL SPORES. Hiroshi Tanooka and Franklin Hutchinson (Japan Atomic Energy Research Inst., Tokyo and Yale Univ., New Haven). Biochim. Biophys. Acta. 95: 690-2(Apr. 19, 1965).

The free radical behavior in irradiated bacterial spores was investigated. B. subtilis spores were irradiated with ^{60}Co gamma rays at a dose rate of 0.81 Mrad/hr at 20°C. Spore samples were subjected to measurement using an electron spin resonance spectrometer. The measured radical concentrations were plotted as a function of dose. The ESR signals were not changed by heat treatment. At 77°K a fine structure different from the pattern obtained by raising the temperature to 300°K was observed. The decay curves of the free radicals are also shown. (M.C.G.)

27970 THE EFFECT OF IONIZING RADIATION ON MELANOCYTE-STIMULATING AND STEROIDOGENIC ACTIVITIES OF CORTICOTROPIN. William E. Paul, Abba J. Kastin, and William D. Odell (National Cancer Inst., Bethesda, Md.). Biochim. Biophys. Acta, 100: 263-9 (Apr. 12, 1965).

Purified porcine corticotropin (ACTH) was irradiated with 2.0-Mev electrons in reduced Ar atmosphere. Residual melanocyte-stimulating and steroidogenic activities of the irradiated samples were measured. Irradiated samples of corticotropin had greater melanocyte-stimulating activities than non-irradiated samples. At $400 \cdot 10^6$ Rad melanocyte-stimulating activity was 340% of that at 0 Rad. Steroidogenic activity diminished with increasing doses of radiation, and a molecular weight estimate of $4.0 \cdot 10^3$ was obtained. The ratio of melanocyte-stimulating activity to steroidogenic activity rose from 1 in non-irradiated samples to 97 in samples irradiated at $600 \cdot 10^6$ Rad. Irradiation of purified α-melanocyte-stimulating hormone in Ar atmosphere caused diminution of melanocyte-stimulating activity. Irradiation of corticotropin in air caused loss of both steroidogenic and melanocyte-stimulating activities at about the same initial rate. This rate was considerably more rapid than that for loss of steroidogenic activity of corticotropin irradiated in Ar. (auth)

27971 THE ORIGIN OF RADIOMUTANTS OF THE CHLORINE TYPE IN ARABIDOPSIS THALIANA L. (HEYNH.). Milan Sosna (Inst. of Experimental Botany, Czechoslovak Academy of Sciences, Prague). Biol. Plant. Acad. Sci. Bohemoslov., 4: 255-9(1962).

Fractionated x-ray doses induce in A. thaliana plants chlorine-type mutations (simple recessive -cc- as compared with the normal type -CC-) characterized by changed proportions of chlorophyll pigment as well as a decreased leaf area, retarded development in the initial phase, and a substantially longer vegetative cycle. The induction of chlorine-type mutation was accomplished by a dose of 6000 R of 50-kv x rays applied in two doses of 3000 R with an interval of 8 hr (irradiation at 8 and 16 hr after soaking seeds). A single dose of either 3000 or 6000 R did not induce the chlorine-type mutations. In the course of future generations, however, these mutant characteristics change in the direction of normal types and stabilize in the sixth generation. A genetic and cytologic evaluation of this phenomenon showed that this mutation is connected with a lesser number of plastids in the assimilative tissues. This number remains standard in all generations of the chlorine type, but on the other hand, the size of the plastids increases. Several experiments involving irradiation of the cotyledons with various doses of x rays showed a characteristic adherence of the plastids, with incomplete and irregular division. On the contrary, in all generations of the chlorine type, the speed and course of division was the same as in the controls (measured in the first development phase). Thus the primary cause of the phenomenon of instability in the chlorine type during the course of four generations is a simple recessive mutation in the composition of the chloroplast pigment combined with a decrease in the number of plastids. The ensuing functional instability is then adjusted in further generations by enlargement in the size of the plastids, within the framework of the reaction range of the given genotype. (BBB)

27972 INFLUENCE OF ALPHA RAYS ON STOMATAL MOVEMENTS. Ferdinand Hercik (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno). Biol. Plant., Acad. Sci. Bohemoslov., 6: 315-17(1964).

Stomata of Begonia semperflorens leaves close after low doses of ultraviolet rays. In preliminary experiments it was observed that irradiation with alpha rays of polonium causes closure of stomata within approximately one hour after irradiation. Results are reported from a series of irradiation experiments with a polonium source performed to determine more precisely the dose-effect dependency. Complete closure of the stomata was used as indication of the reaction. The minimal doses with significant results were $2.2 \cdot 10^6$ $\alpha \cdot cm^{-2}$, the maximum at the dose of approx. $9 \cdot 10^6$ $\alpha \cdot cm^{-2}$ was found. (C.H.)

27973 INTERACTION OF THE BLOOD SERA WITH PARAMECIUM CAUDATUM CULTURES. I. COMPLEMENT CONSUMPTION BY PARAMECIUM CULTURES IN NORMAL FRESH SERA. Stanislav Cabadaj and Milan Praslicka (Safarik Univ., Kosice, Czechoslovakia). Biologia, 19: 889-96(1964).

Methods are described for utilizing the complement consumption by Paramecium caudatum cultures in normal fresh sera of man and rats for evaluating normal and pathological states. In the described modification the tests cannot be used in mice and guinea pigs. In dogs their significance requires further studies to elucidate applicability. In evaluation of the reaction, the activity of the investigated serum is expressed as a number of minimum hemolytic complement doses (NMHD) fixed by the Paramecium culture. In mice, this reaction cannot be used because their blood sera do not hemolyze the sensitized sheep cells used to bind the antigen. Of 17 investigated dogs, in 16 the NMHD value varied within the limits of 0.42–2.85 units (weak reaction) and in one case NMHD = 7.0. In man considerable differences occurred in the described reaction. In 42 adult healthy persons their NMHD values varied from 0.050 to 30. In 20 persons the NMHD was > 5 (strong reaction). In 53 adult rats the NMHD values varied from 1.35 to 30. In 38 rats the NMHD was > 5. After x irradiation the NMHD values decreased. In irradiated rats, however, considerable differences in NMHD levels occurred, whereby high values represented a positive prognostic sign. It is proposed that in human and rat sera there is a component having an antibody character, which with the Paramecium culture forms a complex capable of fixing complement, and therefore hemolysis inhibition of the sensitized sheep cells occurs. The higher the antibody levels are, the higher the NMHD value. For use of the reaction in evaluating survival after midlethal whole-body irradiation, best results are obtained with whole cultures of P. caudatum. (BBB)

27974 THE PHYSICAL STATE OF VIRAL NUCLEIC ACID AND THE SENSITIVITY OF VIRUSES TO ULTRAVIOLET LIGHT. Andrew M. Rauth (Univ. of Toronto). Biophys. J., 5: 257-73(May 1965).

Ultraviolet light action spectra in the range 2250 to 3020 Å were determined for the plaque-forming ability of the following bacteriophage and animal viruses: T-2, ϕx-174, R-17, fr, MS2, 7-S, fd, vesicular stomatitis, vaccinia, encephalomyocarditis, reovirus-3, and polyoma. Absolute quantum yields for the plaque-forming ability of MS2, fr, fd, ϕx-174, and T-2 were determined over the range 2250 to 3020 Å. Relative quantum yields for plaque-forming ability indicated that viruses with single-stranded nucleic acid were on the average ten times more sensitive

to uv than double-stranded viruses. In addition for ten of the twelve viruses a relation existed between the shape of their action spectra and the stranded state of their nucleic acid. The ratio of the inactivation cross section at 2650 Å to that at 2250 Å for these viruses was 1.0 for single-stranded viruses and 2.0 for viruses with double-stranded nucleic acid. The above relations were dependent on the stranded state of the nucleic acid not the ribose or deoxyribose form of the sugar present. (auth)

27975 EXOGENOUS AGENTS WITH CARCINOGENIC ACTION IN MAN: ENVIRONMENTAL CARCINOGENESIS AND OCCUPATIONAL CARCINOGENESIS. Cesare Maltoni. Boll. Sci. Med., 136: 135-43(Apr.-June 1964). (In Italian)

The role of ionizing radiations and other agents in inducing cancer is reviewed. (BBB)

27976 CHANGES IN THE NUCLEOTIDE METABOLISM OF RAT LIVER IRRADIATED WITH ^{60}Co. C. M. Caldarera, V. Pasquinelli, and M. Marchetti (Universita, Bologna). Boll. Soc. Ital. Biol. Sper., 39: 1819-24(Dec. 31, 1963). (In Italian)

This study deals with levels of nucleic acids, free nucleotides, and the aspartic carbamyl transferase and polynucleotide phosphorylase activity of the liver in adult rats irradiated with a total of 600 R (300 R dorsally and ventrally) of ^{60}Co γ rays at 25 R/min. The irradiated animals were sacrificed 48 hr and 30 days later. The nucleic acid was determined by the Schmidt-Thannhauser-Schneider method. The free nucleotides were spectrophotometrically determined after Dowex 1 chromatographic separation. The aspartic carbamyl transferase activity was determined according to the Bresnick and Hitchings method. Values (as mg/g) observed in the controls and irradiated animals after 48 hr and 30 days are presented for DNA, and enzymatic changes in percent observed in nucleotide content in comparison to the controls. This study demonstrates that 600 R of γ irradiation is capable of causing significant variation in nucleotide metabolism. However, these changes were only temporary in nature and were lessened and/or had entirely disappeared after 30 days. The increase in the free nucleotides could be due to an increased synthesis or to decreased utilization of them in polynucleotide synthesis. The increase in the RNA and DNA is difficult to interpret, but these preliminary data could be considered due to decelerated catabolism. (BBB)

27977 TREATMENT BY X RAYS OF BOVINE ALBUMIN IN SOLUTION. R. Santamaria (Universita, Naples). Boll. Soc. Ital. Biol. Sper., 39: 2117(Dec. 31, 1963). (In Italian)

X irradiation of a solution of bovine serum albumin did not produce any electrophoretically detectable modification in the protein denatured with heat or by urea treatment. However, a slow component of albumin showed increased mobility when the irradiated protein was denatured by treatment with urea in pH 8.6 buffer. By independent evaluation of the effects of x rays and urea on the protein it was possible to calculate the velocity of the reactions and the free energy of activation under the experimental conditions used. These calculations reveal the existence of two energetic states in albumin induced by urea when modified by irradiation. (BBB)

27978 ACTIVITY OF URIDINE DIPHOSPHATE GLUCOSE-PYROPHOSPHORYLASE IN THE LIVER OF IRRADIATED RATS. D. Bonsignore, C. Canonica, M. Carrai, and L. Lenzerini (Universita, Genoa). Boll. Soc. Ital. Biol. Sper., 40: 1127-30(Sept. 30, 1964). (In Italian)

These studies investigated the effects of irradiation on the enzymic reaction mediated by uridine diphosphate (UDP) glucose pyrophosphorylase: uridine triphosphate (UTP) + glucose-1-phosphate $\rightleftharpoons$ UDP glucose + pyrophosphate (PP). Adult Wistar rats were whole-body irradiated with 250-kv x rays at a rate of 55 R/min to total doses of 700 R. At various intervals up to 72 hr postirradiation, the animals were sacrificed and liver homogenates prepared. The enzyme was obtained in the supernatant fraction after 10-min centrifugation of the homogenate at 600 G. The enzymic reaction was followed spectrophotometrically at 340 mμ by the conversion of NADP (nicotinamide adenine diphosphate) to the reduced form. The specific enzyme activity (based on liver protein, in mg) was increased 120 to 130% at 12 and 48 hr postirradiation but was nearly normal at 72 hr. The total enzyme activity of the liver was slightly increased at 12, 48, and 72 hr after irradiation, compared with nonirradiated controls. However, these changes were not significantly different from those in control rats. Other studies in this series of the effect of irradiation on glucose metabolism have shown that the accumulation of glycogen in the liver of acutely irradiated animals results partly from inhibition of its degradation and enhancement of its synthesis. (BBB)

27979 BREAST CANCER FOLLOWING MULTIPLE FLUOROSCOPIES. I. Mackenzie (Dalhousie Univ., Nova Scotia, Can. and Victoria General Hospital, Halifax, N. S.). Brit. J. Cancer, 19: 1-8(Mar. 1965).

A series of 50 cases of carcinoma of the breast in women who had previously had sanatorium treatment for pulmonary tuberculosis is presented. Forty of these patients had received treatment which necessitated repeated fluoroscopic examinations of the chest over considerable periods of time. The method used in carrying out these fluoroscopic examinations resulted in the anterior chest wall, including the breast areas, receiving considerable doses of unfiltered x irradiation. It is concluded that this irradiation played a significant part in the subsequent development of the mammary cancers, resulting in a higher incidence of these tumours, and occurring at an earlier age, than would normally be expected. (auth)

27980 SERUM ENZYME ACTIVITY DURING RADIOTHERAPY OF MALIGNANT TUMOURS. L. R. Holsti (University Central Hospital, Helsinki). Brit. J. Cancer, 19: 134-8(Mar. 1965).

The serum activity of aldolase, lactic acid dehydrogenase (LDH), glutamic acid transaminase (GOT), and leucine aminopeptidase (LAP) were determined in patients undergoing split-course megavoltage radiotherapy for various malignant diseases. Enzyme determinations were carried out on 54 patients. GOT and LAP did not increase to a pathological level in 12 out of the 16 patients examined. Aldolase and LDH increased to a pathological level in one-third of the whole material, mainly in lung cancer patients, but hardly at all in patients suffering from oesophageal cancer, cancer of the bladder, cancer of the colon or cancer of the stomach. The pathological increase of aldolase and LDH usually coincided with a favorable primary reaction to radiotherapy. The low activity level of aldolase and LDH during treatment can reveal nothing of the radiation response of lung cancer patients because in 11 out of 19 cases the tumours decreased despite the low enzyme activity. The increase in activity was not revealed as having a connection with the histological structure of the tumour or with the field size used. Of the 8 patients who received post-operative radiotherapy after the removal of the tumor, in only one was a slight increase in aldolase recorded towards the end of treatment. LDH showed no increase whatsoever. (auth)

27981 MECHANISMS OF CARCINOGENESIS: CHEMICAL, PHYSICAL AND VIRAL. Alexander Haddow (Chester Beatty Research Inst., London). Brit. Med. Bull., 20: 87-90(May 1964).

Among other agents, ionizing radiation, as a carcinogen is briefly discussed. (BBB)

27982 THE TUMORIGENIC EFFECT OF X RAYS ON DROSOPHILA (D. MELANOGASTER) AND ITS QUANTITATIVE DEVELOPMENT IN THE COURSE OF ONTOGENY. S. Ghelelovitch (Institut du Radium, Paris). Bull. Assoc. Franc. Etude Cancer, 51: 203-24(Apr.-June 1964). (In French)

The D. melanogaster strain cl tu has a hereditary predisposition to melanotic tumors. Another strain, 8, does not have the genetic predisposition to tumors. The cl tu larvae were exposed to x rays at age 22, 48, or 70 hr. Of the 22-hr controls, 59.2 ± 2.9% developed tumors. After

600 R, 89.8 ± 2.3% developed tumors. After 1200 R, 100% had tumors, and after 2400 R, 93.4 ± 2.1%. Tumor development in the 48-hr larvae was: control, none; 600 R, 60.6 ± 3.5%; 1200 R, 91.8 ± 2.1%; and 2400 R, 93.4 ± 1.8%. At 70 hr, the results were: 600 R, 60.6 ± 4.1%; 1200 R, 83.7 ± 2.3%; and 2400 R, 97.7 ± 1.0%. In a second experiment, after exposure to 300 R, 84.4% of the first larval stage developed tumors. In the second stage, 63.7% developed tumors, and in the third stage, 54.2%. After 600 R the results were: embryos: 85.4% tumor growth; first stage: 80.7%; second stage: 54.9%; and third stage; 42.9%. Radiosensitivity depended on the developmental stage, not the age of the larvae. But the period of change in sensitivity did not correspond to the molting period. Whether the irradiation was done to the eggs or larvae of a given stage, tumors did not become visible until the last day preceding pupation. With an appropriate dose of x rays, tumors can be induced in almost all cl tu larvae, regardless of age. With large x-ray doses (over 2-3000 R) a threshold of inversion was reached. Beyond this threshold the incidence of induced tumors declined. In the cl tu and F_1(cl tu × 8) strains, the statistical distribution of tumors followed the Poisson series, until the multiplicity of tumors increased. In the heterozygotes there was an excess of larvae without tumors and a decrease in frequency of those with only one tumor. (BBB)

27983 RESISTANCE TO LETHAL X IRRADIATION BY THE ACTION OF BLOOD SERA WITH A CULTURE OF PARAMECIUM CAUDATUM. S. Cabadaj and M. Praslicka (Safarik Univ., Kosice, Czechoslovakia). Casopis Lekaru Ceskych, 103: 502(May 3, 1964). (In Czech)

A complement-fixation test using protozoan antigen and the serum of rats irradiated with 550-R doses of x rays is described. Lethally irradiated rats with low serum complement levels survived longer than those with high levels. (BBB)

27984 THE ACTION OF X IRRADIATION ON RAT COMPLEMENT FIXATION BY PROTOZOA. S. Cabadaj and M. Praslicka (Safarik Univ., Kosice, Czechoslovakia). Cesk. Fysiol., 10: 176-7(1961). (In Czech)

A complement-fixation reaction using an antigen from Paramecium caudatum with sensitized sheep erythrocytes and rat serum was developed. In rats subjected to whole-body doses of 400 and 600 R of 180-kv x rays the serum complement levels, as detected by this test, were markedly lowered four hr postirradiation. (BBB)

27985 X-RAY-INDUCED CHANGES IN THE CHROMOSOMES OF LIMOTETTIX (HOMOPTERA). Olli Halkka (Univ. of Helsinki). Chromosoma, 16: 185-91(1965).

Male leafhoppers (Limotettix striola) were irradiated with 250-kv x rays at a 400-R dose. This treatment produced a variable number of chromosome fragments per cell. These fragments survived over a period of seven days, which is probably equivalent to more than one cell generation. A striking difference was observed in the manifestation of irradiation effects at the anaphase stages of the two maturation divisions. At the first division anaphase, bridge formations, and laggard chromosomes were frequently found, while both these types of disturbance were practically absent at the second division. Although many of the first maturation division anaphases had an entirely normal appearance, with the univalent X chromosome lagging behind the autosomes, more than 50% of the anaphases either contained extra laggards or bridges or were otherwise distorted. This was also true of the cysts. In the metaphase plates of the secondary spermatocytes, besides those with normal chromosome numbers, chromosome sets with super- or sub-normal numbers were observed. Very small fragments were rarer at second than at first maturation metaphase. The cysts at second division anaphase were quite different from those at first anaphase and outwardly normal. In spite of some abnormalities found at second metaphase, the disjunction at anaphase occurred in a regular fashion. All the anaphase groups were of about the same size. The conclusion was reached that these peculiarities of irradiated leafhopper testicular cell progenies are best explained if it is assumed that the chromosomes are holokinetic and that the mode of meiosis is prereductional. (BBB)

27986 TECHNIQUES OF STERILIZATION. Edmund W. Overstreet (Univ. of California, San Francisco). Clin. Obstet. Gynecol., 7: 109-25(Mar. 1964).

Use of ionizing radiation and other means for sterilization of women is reviewed. A description of the techniques is given, as well as a comparison of their simplicity of performance, safety, and dependability. In the x irradiation of ovaries by the transabdominal approach, the objective is termination of ovulation; but in the process, cyclic ovarian endocrine function is also ablated, with cessation of menses and induction of artificial menopause. The principles of technique are as follows: The dose necessary for permanent castration varies with the age of the patient, younger patients requiring higher dosage. While single doses of about 400 R to each ovary have been advocated, in some women (especially in the younger age groups) this may produce only temporary amenorrhea. Preferable is a dosage of 1500 to 2000 R to each ovary, administered over a period of two to three weeks. This dosage is readily tolerated and is more reliable. There are no reliable data relating incidence of failure to castrate to the dosage delivered; but in some cases, especially after lower doses, resumption of ovulation and menses may occur, and pregnancy has been reported. Intrauterine Ra application was much used in earlier years but practically abandoned in current therapy. The insertion of Ra into the uterine cavity accomplishes sterilization by two effects: (1) delivery of radiation dose to the ovaries to accomplish radiotherapeutic castration, and (2) a cauterization effect upon the endometrium. One technique is as follows: An intracavitary tandem of Ra sources is used. A dose of 1000 to 2500 mg-hr is usual, providing doses to the ovaries estimated at 300 to 600 R. This Ra exposure yields radiation dosage to the uterine and adjacent structures far in excess of that from external radiation for castration; yet it often provides an insufficient dose to the ovaries. Furthermore, relatively small variations in position of either ovary with respect to the intrauterine source make delivery of an adequate dose to both ovaries highly uncertain. Important is the fact that intracavitary Ra application may temporarily mask an early endometrial carcinoma. For this reason, external radiation for castration is preferable. However, in the opinion of the author, irradiation techniques are contraindicated today, the various surgical procedures being preferred. These are described in detail. (BBB)

27987 THE MANAGEMENT OF PATIENTS GIVEN WHOLE-BODY IRRADIATION OR ANTIMETABOLITES TO PROMOTE THE SURVIVAL OF A RENAL HOMOTRANSPLANT. M. F. A. Woodruff (Univ. of Edinburgh). Clin. Radiol., 15: 30-4(Jan. 1964).

Measures used to prevent infections in a patient receiving irradiation to prevent homograft rejection after renal transplantation are described in detail. Two days before transplantation the patient received whole-body and local irradiation. Two fields to each side were required to cover the whole length of the patient and the fields were allowed to overlap slightly so as to avoid any possibility of a gap occurring between them. Using a 2-Mev Van de Graaff apparatus, a maximum dosage of 200 rad was delivered to the trunk, with a minimum central dose of 150 rad. With an incident dose-rate of 9.7 rad/min the treatment of each field was completed in 17.5 min. Immediately after completion of the whole-body irradiation additional treatment was given to the spleen and to the right lower abdomen. Here anterior and posterior fields were employed and in both areas the maximum dose was 110 rad and the minimum dose 100 rad. The incident dose-rate was 100 rad/min and the treatment time for each field was 50 sec. For several days before and after irradiation the patient was given chlorpromazine by mouth. After irradiation the patient was nursed in a

special air-conditioned isolation unit by a team of six nurses, two of whom were on duty at a time. The unit was ventilated by filtered air under positive pressure so that the air flow was constantly from the patient's room to other parts of the unit. Floors were mopped and ledges were wiped with a 2.5% solution of Sudol several times daily. Bedding, surgical dressings, and gowns were autoclaved. Entry to the patient's room was reduced to a minimum and when a visit had to be made the doctor or nurse (who had already bathed and changed on first entering the unit) scrubbed up and put on a sterile gown. Observations of temperature, pulse and respiration rate, blood pressure, and electrocardiograph were made from the nurse's station by remote control electronic equipment. Eleven days after operation the patient was given a further 50-rad whole-body irradiation because of apparent onset of an immunological reaction. Sixteen days after the original irradiation the blood platelets had fallen to a dangerously low level. Leucocytes of all types disappeared completely from the blood stream, and in consequence the patient's capacity to resist infection was greatly impaired. The rigorous aseptic precautions sufficed to prevent serious infection from without, but a month after operation, when the transplant was functioning reasonably well, one patient developed a fatal septicemia due to streptococci present in her alimentary tract. Invasion of the blood stream was presumably facilitated by irradiation damage to the intestinal epithelium. Results with Imuran used instead of radiation to suppress immunological reactions, in several other patients, are described. (BBB)

27988 INVESTIGATIONS ON THE ACTION OF NATURAL IONIZING RADIATIONS ON THE GROWTH OF ONE-CELL ANIMALS. Hubert Planel, Jean-Pierre Soleilhavoup, and Rene Tixador (Faculte de Medecine, Toulouse). Compt. Rend., 260: 3770-3(Mar. 29, 1965). (In French)

The growth of Paramecium caudatum was studied under normal conditions of culture or under the protection of lead screens in order to determine the effects of natural ionizing radiations. The results seemed to show that these radiations exercise, in spite of their low intensity, an effect on living animals and probably create an ionization state which appears indispensable for the multiplication of the animals. (J.S.R.)

27989 RADIATION ACCIDENTS. PART II. HOW TO RECOGNIZE AND TREAT IT. IV. DIAGNOSIS AND THERAPY. A. DIAGNOSIS OF RADIATION DAMAGE. Marshall Brucer. Conn. Med., 28: 255-7(Apr. 1964).

Diagnosis of radiation injuries following a radiation accident is discussed, considering three categories: (1) Low-dose or incidental injury. If less than 100 R exposure, the patient will probably manifest, if anything, only incidental injury during the first two months. (2) Medium-dose or possibly severe injury. If the patient has been exposed to between 100 and 1000 R, an acute radiation syndrome will occur. At 100 R the injury will be minor; at 1000 R lethal. (3) High-dose or probably lethal exposure. In this range the physician probably can only express humanitarian concern and give terminal care. Methods for taking the patients' history, physical examination, and lab tests are outlined. Blood counts may show some effect and should be a matter of routine, following standard operating procedures. If contaminated, it will be necessary to isolate the patient, all his clothing, and everything his skin or clothing touches. Patients who have been exposed to neutrons (certainly), high-energy particles (probably), and very-high-energy electromagnetic radiation (possibly) might show some induced radioactivity. This is not contamination and cannot be removed by decontamination procedures. A rough estimate of contamination can be made in any hospital radiology department, private medical or dental office, with photographic film. An unexposed film wrapped in dark paper is placed near the body for a few minutes, then is developed. Following irradiation, there may be an excess of creatine in urine due to inability of irradiated muscle to utilize creatine. Along with creatinuria there is an increase in the excretion of β-aminoisobutyric acid (BAIBA). BAIBA excretion appears to be roughly related to dose and to increase for only a few days and then it returns to almost normal levels. However, there are as yet no good biological indicators of radiation damage that can be used in diagnosis or prognosis. Diagnostically, bone marrow aplasia is an almost quantitative indication of the degree of radiation damage that has occurred within the medium range of human exposure. The far more easily demonstrated leukopenia and thrombocytopenia on peripheral blood give almost as much diagnostic and prognostic information. (BBB)

27990 RADIATION ACCIDENTS. PART II. HOW TO RECOGNIZE AND TREAT IT. IV. DIAGNOSIS AND THERAPY. B. THE TREATMENT OF ACUTE RADIATION DAMAGE. Marshall Brucer. Conn. Med., 28: 258-60(Apr. 1964)

There is no specific therapy for acute radiation injury. Therapeutic vitamins, ACTH, biologicals, and antibiotics all have been recommended, but they have no value. Some symptomatic treatment, though not specific, appears to be of value. It is assumed that every physician will maintain the nutritional status of any patient. In the low range of radiation dose (less than 100 rad) probably no therapy is desirable other than reassurance. In the high range (greater than 1000 rad) probably nothing effective can be done, except to make the patient comfortable, to treat vigorously every symptom that appears, and to use any experimental procedure that might be indicated. In contamination accidents, it is necessary to institute decontamination procedures early. These are simple and easily applied. Warm water and soap are sufficient to remove most contamination. The application of chelating agents has usually been unsuccessful but might, depending upon the isotope, be of value. During the first few hours following an accident the patient should be admitted to the hospital after an exposure of about 250 R. There is some evidence that donor bone marrow, even though not a permanent graft, will assist the patient during the most severe phase of radiation sickness, but bone marrow replacement should be considered radical therapy. During the period of developing infection the use of antibiotics is desirable. It is questionable that antihemorrhagics are of any value, but platelet-enriched transfusions and use of fresh, whole blood are probably of lifesaving value when they are indicated by hematologic data. (BBB)

27991 RADIATION ACCIDENTS. PART II. HOW TO RECOGNIZE AND TREAT IT. IV. DIAGNOSIS AND THERAPY. C. THE CHRONIC RADIATION CHRONIC SYNDROME. Marshall Brucer. Conn. Med., 28: 261-3(Apr. 1964).

Treatment of late effects of irradiation after external exposure or internal contamination with radioisotopes is discussed. Determination of the extent of internal contamination is considered. A rule to follow is that when the radiation reading is ten times the background (for the particular machine used to make the reading), it is probably worth considerable medical risk to reduce the internal contamination. This is particularly true for chemicals known to be toxic; but not for chemicals known not to be toxic. It is particularly true for radioactive materials known to have a long half-time in the body; it is probably too stringent a requirement for chemicals known to have a short half-time in the body. Where the radiation reading is less than ten times the background, therapy to remove the contamination is probably only worth a minor medical risk. To get rid of the contamination surgical removal is best if it can be done without much risk and without unnecessary deformity. Medical removal is more difficult for ingested materials; emetics, purges, and enemas are indicated. Emetics are valuable only in the first few minutes. Purges are valuable only within the first few hours and enemas are valuable only when there is definitely some activity in the feces. Various chelating agents are valuable early after absorption and while the material is still in the blood stream. Depending upon the compound ingested, they become less valuable with time. The chronic effects of the

radiation are treated symptomatically just as in acute radiation damage. The chronic effects include cancers, leukemias, shortening of the lifespan, genetic abnormalities, and birth defects. Effects on children exposed in utero are discussed. There is no specific therapy that can be applied to the children. A sublethal total-body radiation dose to a mother during the first semester of pregnancy is an indication for a therapeutic abortion. The usual therapeutic procedures for the acute radiation syndrome apply to the mother. There is no therapy for the fetus. (BBB)

27992 RADIATION ACCIDENTS. PART II. HOW TO RECOGNIZE AND TREAT IT. IV. DIAGNOSIS AND THERAPY. D. A SUGGESTED PLAN OF MEDICAL ACTION. Marshall Brucer. Conn. Med., 28: 264-5(Apr. 1964).

Procedures are outlined for the care of patients exposed to radioactive contamination during radiation accidents. The suggested order of procedure for physicians involved in a radiation accident is as follows: (1) Remove patient from area. (2) Give immediate first aid. (3) Call for Health Physics staff help. (4) Isolate patient to prevent infection (and contamination of others). (5) See that danger area is closed off. (6) Determine (a) Is the patient contaminated? With what? Were neutrons or heavy particles involved? (b) What is the approximate level of radiation exposure? (7) If contamination is present, clean up gross contamination, remove clothing, give preliminary wash. (8) Measure contamination. (9) Put patient to bed. (10) Save all samples: clothes, blood, urine, feces, vomitus, hair, nails, sheets. (11) Do routine blood count, freeze and store a 10-ml sample of blood. (12) Give sedation, if indicated. (13) Send patient to hospital if more than 100 R exposure suspected. (14) Brief the administrator and the public relations office. (BBB)

27993 THE INDUCTION OF CHROMATID LESIONS BY CYTOSINE ARABINOSIDE IN POST-DNA-SYNTHETIC HUMAN LEUKOCYTES. J. G. Brewen (Oak Ridge National Lab., Tenn.). Cytogenetics, 4: 28-36(1965).

When cultures of human leukocytes are treated with tritiated thymidine and cytosine arabinoside, it is observed that all of the aberrations induced by the cytosine arabinoside are induced in unlabeled (G_2) cells. Furthermore, very few labeled cells reach metaphase, indicating that the cells in S at the time of treatment are either slowed or stopped in their progression to metaphase. The time from the end of S to metaphase is estimated to be $2\frac{1}{2}$ to $3\frac{1}{2}$ hr in normal cultures. (auth)

27994 TRANSPLANTATION: THE SCIENTIFIC BACKGROUND. P. B. Medawar (National Inst. for Medical Research, London). Discovery, 26: 22-6(Mar. 1965).

Bases for the homograft reaction are reviewed, with a consideration of the effect on it of ionizing radiation and other immunodepressive agents. (BBB)

27995 ORGAN TRANSPLANTATION. R. Y. Calne (Westminster Hospital, London). Discovery, 26: 28-32 (Mar. 1965).

Renal homotransplantation is discussed, including the action of x rays in preventing the homograft rejection reaction. (BBB)

27996 RATE OF CHROMOSOMAL ABERRATIONS, AS DEPENDENT ON THE DOSE AND INTENSITY OF SEED TREATMENT WITH γ RAYS. N. I. Nuzhdin and K. A. Filev. Dokl. Akad. Nauk SSSR, 159: 1151-3(Dec. 11, 1964). (In Russian)

The effects of ^{60}Co γ-ray dose and intensity on mutagenic processes and chromosomal aberrations were studied in seeds of Bulgarian barley (1962 spring harvest) treated with doses 1, 5, 10, and 18 kR and intensities 16, 47, 81, and 253 R/min. Tabulated data indicated a definite relationship between the frequency of chromosomal aberrations and the dose and intensity of γ treatment. Diagrams illustrate the ratio of synoptic cells and fragments among the recorded abnormal mitoses. (R.V.J.)

27997 ON THE EXISTENCE OF SYSTEM IN THE RESPONSE OF BIOLOGICAL OBJECTS TO IRRADIATION (ANALYSIS OF DATA OBTAINED ON PARAMECIUM CAUDATUM). G. K. Ochinskaya and I. B. Bychkovskaya (Central Scientific-Research Inst. of Roentgen-Radiology, USSR). Dokl. Akad. Nauk SSSR, 160: 461-3(Jan. 11, 1965). (In Russian)

The survival and average lifetime of Paramecium caudatum irradiated with a gamma dose of ^{60}Co that was gradually increased from 360 to 1200 kR were determined in order to find out whether or not the radiation dose had an effect on the degree of damage to a single-cell organism. On plotting the precent survivals as a function of time in days, it was found that the data fall into three groups. The survival does not depend on dose within any one group, but the average survival time varies significantly on going from one group to another. Thus, the average survival time is 18 days at a dose of 360 to 485 kR (Group I), 10 days at a dose of 510 to 850 kR (Group II), and about 1 day at a dose of 900 to 1200 kR (Group III). Within the above dose limits, a change in dose did not lead to a change in the average lifetime. A shortening in lifetime was observed only after attaining a certain threshold dose (360, 510, or 900 kR). The results indicate that the radiation damage to the infusoria takes place in definite stages, probably by damage to a vitally important system of the single-cell organism. (TTT)

27998 EFFECT OF GAMMA RAYS AND VIBRATION ON THE PHYSICAL AND CHEMICAL NATURE OF RED BLOOD CELLS. Yu. A. Kriger and E. A. Sverdlova (Moscow State Univ.). Dokl. Akad. Nauk SSSR, 160: 713-16 (Jan. 21, 1965). (In Russian)

An attempt was made to investigate the influence of gamma radiation and vibration on the dielectric and osmotic qualities and the cation balance of erythrocytes. Tests were conducted on human whole blood from which the erythrocytes had been separated from the plasma and placed in a physiological Ringers solution. The preparations were subjected to irradiation from a GUT-^{60}Co-400 unit in doses of 4.6, 30, and 80 kiloroentgen, which varied from 775 to 2231 r/min. Vibration took place on a VU-15 stand at 70 cps and an amplitude of 1 mm for 60 min before, during, and after irradiation. All remaining measurements took place 24 hr after radiation. The storage temperature was 4°C to reveal the maximum damaging effects of radiation and vibration. It was found that neither 80 kR nor subsequent vibration affected the dielectric or osmotic nature of human blood. The results held true for samples exposed to simultaneous radiation and vibration. Measurements of the release of calcium from erythrocytes 5–7 hr after irradiation (4.6-, 30-, and 80-kR doses) and subsequent vibration (1-hr interval) revealed that with an increased radiation dose, there was an increase in calcium release. Vibration, however, did not intensify this process in either the experimental or control groups. This showed that sucrose had a far more deleterious effect on irradiated erythrocytes than on intact erythrocytes. The osmotic resistance of erythrocytes in whole blood was increased upon exposure to 80 kR, which agreed with the results of other investigators. However, the osmotic resistance of erythrocytes in a physiological solution was lowered upon exposure to the same dose. This was probably due to the fact that plasma acted as a radioprotective agent. Vibration did not affect the osmotic resistance of either irradiated or control erythrocytes. (ATD)

27999 EFFECTS OF RADIATION ON THE GERMINATION AND GROWTH OF RAUWOLFIA SERPENTINA BENTH. Toyohiko Kawatani and Seizaburo Hemmi (National Inst. of Hygienic Science, Tokyo). Eisei Shikenjo Hokoku, 80: 166-7(Sept. 1962). (In Japanese)

R. serpentina seeds were soaked in distilled water overnight and irradiated by ^{60}Co before being planted. Five sample groups, each receiving a different radiation dose (R_0 0 r, R_1 500 r, R_2 1000 r, R_3 5000 r, R_4 10,000 r) and each consisting of 200 seeds, were planted in wooden pots first in a greenhouse and about 14 months later in the field.

The rate of germination and length of the germination period, plant height, root length and diameter, live and dried root weights were examined. Within a two-month period the germination was completed. The results showed that there was no significant difference in germination rate among the groups, although Group R_4 required a significantly longer period of germination than Group R_0. No significant difference in period of germination, however, was found among groups R_0, R_1, R_2, and R_3. Compared to the control group R_0, R_4 showed lower plant height and shorter root length, but no significant differences were found in other parameters measured. Thus, with the exception of R_4, no significant differences in growth characteristics were found among the rest of the irradiated groups. (BBB)

28000 PREVENTION OF PYCNOSIS IN RAT THYMOCYTES. D. K. Myers (Atomic Energy of Canada Ltd., Chalk River, Ont.). Exptl. Cell Res., 38: 354-65(May 1965).

The development of pycnotic nuclei in irradiated thymus cells during incubation at 37°C in vitro is minimal at low pH values and is accelerated at high pH values. In contrast, the development of other signs of cell degeneration, loss of intracellular potassium and absorption of erythrosin stain by intact cells, was minimal at pH values near 6.2 and was accelerated either at lower or at higher pH values. Pycnosis at pH 7.5 was also prevented by respiratory inhibitors, e.g., dinitrophenol, cyanide, arsenite, iodoacetamide, high doses of x radiation, or cationic condensing agents. From these results, it was concluded that pycnosis represents a physical dispersion of nuclear components which can be prevented either by treatments which irreversibly denature the nuclear proteins or by treatments which cause a reversible gelation of the nucleoplasm due to increased acidity. The lysis of cell nuclei is reportedly inhibited by the same treatments. The absence of nuclear pycnosis does not necessarily indicate absence of cell damage. In most but not all of the experimental conditions tested, potassium loss was correlated with erythrosin staining but it developed at an earlier stage of cell degeneration. Of the three criteria, the loss of intracellular potassium appeared to provide the most reliable index of damage to the thymus cells. (auth)

28001 CHANGES INDUCED IN THE FIRST POST-IRRADIATION GENERATION CYCLE OF HUMAN CELLS STUDIED BY DOUBLE LABELING. D. Bootsma (TNO, Rijswijk, Netherlands). Exptl. Cell Res., 38: 429-31(May 1965).

A method is presented for studying x radiation effects on population dynamics in tissue cultures. Human kidney cells were labeled with ^{14}C-2-thymidine prior to irradiation and with ^{3}H-thymidine following irradiation. Radioautographic studies indicated a very strong mitosis-delaying effect on cells irradiated in G_2 phase. Cells irradiated in G_1 were very slightly affected, if at all. (H.G.D.)

28002 CHANGES IN ERYTHROPOIETIC ACTIVITY OF BLOOD SERUM AND GASTRIC CONTENTS IN PATIENTS WITH POLYCYTHEMIA VERA FOLLOWING TREATMENT WITH P^{32}. Z. T. Belugina and L. V. Mytarova (Central Research Inst. of Medical Radiology, Leningrad). Federation Proc., Transl. Suppl., 24: T455-8(May-June 1965). Translated from Terapevt. Arkh., 36: No. 4, 41-?(1964).

A study of the changes in the concentration of gastromucoprotein and the erythropoietic activity of the blood serum and gastric juice of patients with polycythemia vera following treatment with ^{32}P is described. The concentration of gastromucoprotein in the patients rose or, more rarely, remained unchanged by comparison with its value before treatment. The erythropoietic activity of the gastric juice, as determined by the rat reticulocyte reaction, fell appreciably after treatment of the patients. This gives added configuration that gastromucoprotein is not identical with the erythropoietic factor of the stomach. (H.G.D.)

28003 CRITICAL PERIODS IN DEVELOPMENT OF LIMB PRIMORDIA IN MOUSE EMBRYOS AND THEIR DETERMINATION FROM EXPERIMENTS INVOLVING X-IRRADIATION. L. G. Neverova (Inst. of Experimental Medicine, Leningrad). Federation Proc., Transl. Suppl., 24: T459-62(May-June 1965). Translated from Arkh. Anat., Gistol. i Embriol., 46: No. 4, 63-?(1964).

An attempt was made to determine the radiation injury to the limbs of mouse embryos at different stages of development with the same dose of radiation. Following irradiation on the 9th day, before the forelimb buds appear, and on the 10th day of development, when they have only just appeared, the size of the limbs increases (increased length and earlier appearance of the ossification centers in the forelimbs, and larger ossification centers and cartilage models of the long bones of the hind limbs). Ionizing radiation apparently has a stimulating effect on the limb primordia at this stage of development, when the skeletogenous mesenchyma is not yet determined. Following irradiation on the 11th day (the stage of determination of the skeletogenous mesenchyma at the sites of the long bones), damage to the long bones is a common feature in the fetuses. The 12th day of development is the stage of determination of the skeletogenous mesenchyma to form the paws. Anomalies of the digits are observed following irradiation at this period. The 11th and 12th days of embryonic development are the critical period in development of the limb as a whole. Irradiation at this time causes anomalies of the limbs in 97.6% of mouse embryos. Following irradiation on the 13th day of development, when determination of the skeletogenous mesenchyma has already occurred, ionizing radiation again has a stimulating rather than a damaging effect. There were no external abnormalities of the limbs following irradiation on the 14th day of pregnancy. (auth)

28004 REDUCTION OF NATURAL RESISTANCE TO LIVE BRUCELLA VACCINE IN IRRADIATED ANIMALS. Z. V. Shevtsova (Gamaleya Inst. of Epidemiology and Microbiology, Academy of Medical Sciences, USSR). Federation Proc., Transl. Suppl., 24: T470-2(May-June 1965).

An increased death rate was noted when a live or heat killed vaccinal brucella culture, and endotoxin extracted from it, were injected into irradiated animals. The rate of multiplication of the brucella of the vaccinal strain and residual virulence were not increased. Increased sensitivity to brucella endotoxin is the major factor behind the reduced resistance of irradiated animals to the vaccine strain No. 19-BA of Brucella abortus. (auth)

28005 DNA-ase ACTIVITY OF THE URINE OF INTACT ANIMALS AND ANIMALS IRRADIATED WITH X-RAYS. N. E. Khursin (Bogomolets Inst. of Physiology, Academy of Sciences, Kiev). Fiziol. Zh., Akad. Nauk Ukr. RSR, 11: 223-4(Mar.-Apr. 1965). (In Ukrainian)

The DNA-ase activity of the urine was determined with the aid of a horizontal viscosimeter. The substrate for ascertaining the effect of the enzyme was obtained from bird erythrocytes. The activity of the enzyme was judged by the change in viscosity of the substrate. The experimental data were processed statistically. As a result it was established that DNA-ase I is a constant component of the urine in man and animals (dogs, rats, mice); the DNA-ase activity in rat and mouse urine is higher than in dog urine. The least activity was found in human urine. The lowest x-ray dose (single irradiation) at which a perceptible increase in the DNA-ase activity of albino mouse urine was noted varies between 25 and 100 R. On increase the x-ray dose to 600 and 1200 R no proportional increase in DNA-ase I activity in mouse urine was noted. On irradiating mice and dogs with x rays an increase in the DNA-ase I activity of the urine was invariably observed in early periods after irradiation. (auth)

28006 INFLUENCE OF X-RAYS AND THYMECTOMY ON THE COURSE OF PARABIOTIC INTOXICATION AND IMMUNOLOGICAL TOLERANCE IN PARABIOSIS OF INBRED MICE. J. Kacza (Inst. of Biology and Embryology, Medical Academy, Krakow). Folia Biol. (Warsaw), 13: 1-21(1965).

Mice of parental strain were irradiated with various

doses of x-rays at various times before parabiosis in order to weaken their immunological reactivity towards the F_1 hybrid partner, simultaneously suppressing parabiotic intoxication and prolonging the survival of animals in parabiosis. Total thymectomy was also performed. Results showed that a single irradiation of the parental strain partner with a dose of 400 R prolonged survival time of parabiotic mice due to the weakening of parabiotic intoxication. In some cases, survival prolongation during parabiosis brought about a condition of partial immunological tolerance for F_1 hybrid skin grafts. However, combined thymectomy and irradiation failed to reduce, in any great measure, the immunological reactivity of the parental strain partner against the hybrid's antigens. (H.G.D.)

28007 PLASTIC SURGERY IN THE HIROSHIMA ATOMIC BOMB PATIENTS. Arthur J. Barsky, Bernard E. Simon, and Sidney Kahn (New York Univ., New York). Fortsch. Kiefer- Gesichtschir., 8: 84-90(1962).

Ten years after the atomic bombing of Hiroshima, 25 young women with severe facial scars from burns experienced during the explosion were sent to New York City for plastic surgery. This report describes and illustrates the results of this surgery. Most of the injuries were on the left side, and the patients revealed that most of them had been facing toward the blast and had been at about 1500 m from hypocenter. Their disfigurements were scars varying from thin plastic mobile scars to dense, heavy, pigmented keloids. Although most of them had suffered from initial radiation illness, the only physical lesions were scars and contractures, the result of thermal burns. The lesions themselves were not radiation injuries. Of the 170 operations performed, some were done by two teams working simultaneously on the head and on the hands; 56% of the cases had a combination of hand and facial injury. The problems which were encountered in addition to the actual problem of contracture and distortion were those of keloid formation and hypertrophic scar, hyperpigmentation of grafts and pedicles, and the difficulty of finding proper donor sites. Although free grafts were widely used, pedicle graft coverage was favored because of the depth of scar excision in most cases. Where arm and facial injuries existed simultaneously, tube pedicles used to cover both face and hand were favored. The accompanying illustrations show a wide variety of methods and include the release of severe ectropion of upper and lower eyelids by means of a free graft and intermarginal adhesions, resurfacing of face and neck using a single tube pedicle split diagonally to accommodate both structures, and the use of a direct upper arm flap to resurface a severe contracting burn of one cheek. (BBB)

28008 RADIATION REACTIONS OF THE RECTUM AND SIGMOID IN X-RAY IMAGES. H. G. Claus (Johannes-Gutenberg-Universitat, Mainz). Fortschr. Gebiete Roentgenstrahlen Nuklearmed., 102: 405-17(1965). (In German)

Reactions to radiation affecting the rectum and sigmoid colon are more frequent than is commonly supposed. The course and end results of large bowel lesions caused by irradiation are demonstrated radiographically. (auth)

28009 THOROTRAST TUMOR AFTER INTRAOPERATIVE CHOLANGIOGRAPHY. A REPORT OF THE DIAGNOSTIC IMPORTANCE OF COELIACOGRAPHY FOR BILE DUCT CARCINOMA. W. Wenz (Universitat, Heidelberg). Fortschr. Gebiete Roentgenstrahlen Nuklearmed., 102: 570-5(May 1965). (In German)

One-hundred-ten tumors due to thorotrast were described in the literature. A case report is added concerning a 61 year old patient who developed a carcinoma of the bile duct in the region of a radioactive deposit 23 years after an unsuccessful operative cholangiogram using thorotrast. In the diagnosis a selective coeliac axis arteriogram proved valuable. This demonstrated changes in the hepatic artery and obstruction in the portal vein. At operation peritoneal carcinomatosis was found. Histologically a mucus secreting carcinoma was demonstrated. The radioactivity of the thorium-containing depot in the right upper abdomen could be confirmed by means of a total body counter. (auth)

28010 NON-MENDELIAN MEGAGAMETOGENESIS IN ARABIDOPSIS. G. P. Redei (Univ. of Missouri, Columbia). Genetics, 51: 857-72(June 1965).

An Arabidopis mutation is described that was not transmitted through the egg, was inherited relatively normally through the sperm, produced abnormal ratios of linked markers, and appeared to segregate in a non-Mendelian way. The three unusual consequences of the x radioinduced (1200 R) mutation were determined by a single pleiotropic factor. Transmission of the carrier strand through the male was about 32%. This is at variance with the Mendelian principle of random segregation. Renner-effect and polyspory were ruled out; preferential segregation had not been ascertained. On the basis of embryological observation, megasporocyte selection is suggested as a possible mechanism responsible for the apparent discrepancy from the second Mendelian law. For a specific chromosome region, recombination in the presence of this factor is lower in the female than in the male ($P = 0.01$). The relation of megasporocyte selection to the crossing-over difference in the two sexes is not clarified by the experiments. (H.G.D.)

28011 MUTAGENIC ACTION OF MITOMYCIN C ON DROSOPHILA MELANOGASTER. Ramen Mukherjee (Univ. of British Columbia, Vancouver). Genetics, 51: 947-51 (June 1965).

Oregon-R males were treated in the following ways: mitomycin C (100 μg/ml); 0.7 N NaCl; mitomycin C (100 μg/ml) and γ rays; and 0.7 N NaCl and γ rays. Each treated male was tested for induced sex-linked recessive lethal mutations by the Muller-5 technique for eight successive daily broods. Mitomycin C is mutagenic in all cell stages in Drosophila, with a peak mutation frequency of 5.0% occurring in the third brood. The γ-ray series reached a peak of 5.8% in the fifth brood. Additivity of effect upon combined Mitomycin C and γ-ray treatment was not always indicated, significant decreases occurring in Broods 3 and 6 and an increase in Brood 8. (auth)

28012 BRIEF REVIEW OF OUR RECENT RESEARCH ON RENAL TRANSPLANTATION. J. Hamburger. Helv. Med. Acta, 31: 329-34(Nov. 1964). (In French)

Use of radiation in recipients of kidney homotransplants is described, with reference to 39 cases. Whole-body ^{60}Co irradiation of 350 Rad in two sessions was used at 28 hr and five days after transplantation. The thymus was also irradiated with 1500 Rad. In some cases chemotherapeutic agents such as Imuran were also used. Of 39 transplantations, 25 showed prolonged survival, and 21 recipients are now in good health. (BBB)

28013 EFFECTS OF X RAYS ON THE SYNTHESIS OF FATTY ACIDS FROM GLUCOSE IN THE MOUSE IN VIVO. F. Geissbuehler and P. Favarger (Universite, Geneva). Helv. Physiol. Pharmacol. Acta, 22: 162-73 (1964). (In French)

Previous data indicate that lipogenesis is accelerated by irradiation, but that irradiated animals are not capable of adapting lipogenesis to changing physiologic conditions. On the other hand, degradation of carbohydrate increases as a result of irradiation. Present experiments were designed to further define the site of action of radiation on fat and carbohydrate metabolism. Nine mice received 600 R distributed over their entire body surface; they were given a strictly defined diet, and then received an intravenous injection of 22 μC of 1:1 mixture of 1- and 2-^{14}C glucose. They were sacrificed 12 min later, and the palmitic acid in their carcasses was isolated. A control group of nine mice was subjected to identical conditions, with the exception of the irradiation. The radioactivity of the palmitic acid and its C_1 and C_2 carbons was measured. The ratio between these radioactivities suggested that the palmitic acid synthesis mechanism is not influenced by irradiation. In contrast, the part played by the oxidative pathway in the metabolic breakdown of glucose appears to be greater in the irradiated animals, in which

lipogenesis also seems to be more active. Elevated lipid formation in irradiated animals indicates that the site of action of radiation on cellular enzyme systems does not involve systems controlling fatty acid synthesis. The effect of radiation on lipid synthesis may be mediated by hormonal or neural factors. (BBB)

28014 THE HAZARDS OF LOW VOLTAGE RADIATION. Louis Pelis, Jr. (General Telephone Co. of Indiana, Fort Wayne). Ind. Med. Surg., 33: 866-8(Dec. 1964).

Injury to human tissues associated with commercial and industrial devices emitting nonionizing radiations is discussed. The microwave region considered extends from the highest radio frequencies down to the ultrahigh frequency band between 300 and 3000 Mc but radiation hazards may exist at any radio frequency capable of being absorbed by the body. Hazardous sources of microwave include various kinds of radar transmitters, tropospheric scatter transmitters, industrial induction heating equipment, microwave installations for communication purposes, and diathermic equipment. The chief effect of microwave energy on living tissue is to produce heating; consequently, exposure to microwave radiation probably represents no great hazard unless overheating is a possibility. The problem of establishing tolerable levels of radiofrequency (RF) radiation is discussed. First, knowledge of susceptible materials or objects is required. Second, environmental conditions to which the materials or objects will be subjected are important factors. Other complicating factors are lack of understanding of fundamental phenomena causing ignition in susceptible items and lack of adequate instrumentation for making reliable measurements. Tolerable levels of RF radiation are considered. At present a tentative level of 10 mw/cm^2 total body irradiation has been accepted by the Armed Forces for humans. However, this level is not a universally accepted standard. Protective materials are being studied and are considered to be those substances that could be used directly or indirectly to protect human beings, electroexplosive devices, or flammable vapors or gases from intense RF fields. Examples include protective RF radiation clothing and RF absorbing materials. In addition to the known hazards to personnel which result primarily from thermal effects, two more are mentioned. There may be an electrical effect on nerve impulse propagation; also, at times gases such as sulfur hexafluoride (used as waveguides to increase the dielectric strength) may decompose and release toxic fluorine. To minimize the hazards of RF radiation, nine recommendations are made. (BBB)

28015 A HISTOPATHOLOGIC STUDY OF CARCINOMA OF THE UTERUS FOLLOWING IRRADIATION FOR DYSFUNCTIONAL UTERINE BLEEDING. Vatsala V. Vakil and M. V. Sirsat (Tata Memorial Hospital, Bombay). Indian J. Med. Res., 52: 368-75(Apr. 1964).

The marked stromal alterations observed in four cases of uterine carcinomas which developed several years following a radioinduced menopause of dysfunctional bleeding are described. These four cases consisted of three endometrial carcinomas, one of which also showed a small independent focus of an adenocarcinoma in the cervix. The fourth case showed an unusual association of an adenocarcinoma of the gyriform type with a squamous carcinoma in the cervix. The stromal changes, studied by a variety of staining techniques, consisted of hyalinized fibrosis of the myometrium, marked hyaline thickening of the blood vessels with narrowing or even complete obliteration of the lumina. Subepithelial collagen in the cervices showed evidence of hyalinization and fragmentation. There was a quantitative increase in elastic tissue in the myometrium associated with fragmentation in the form of irregularly scattered tangled masses. Cervices also showed hyperplasia of elastic tissue and fragmentation beneath the stratified squamous epithelium, with a complete disappearance in the region of the carcinoma. The alterations in the collagenous tissue and the blood vessels are believed to be specific radiation changes, as they were absent in the nonirradiated controls. It is suggested that these stromal changes lead to a marked deterioration in the nutritional status of the overlying epithelium and thereby lead to its malignant transformation. It is considered probable from the evidence presented that the previous irradiation was the cause of malignant transformation in these cases. (BBB)

28016 COMPARATIVE SEROLOGIC REACTIVITY OF ^{131}I AND ^{125}I LABELED HUMAN SERUM ALBUMIN PREPARATIONS. Stephen A. Aron, Michael J. Rose, Jr., and Bernard W. Janicki (Veterans Administration Hospital, Washington, D. C.). Intern. Arch. Allergy Appl. Immunol., 26: 255-63(1965).

Qualitative and quantitative relation between ^{125}I-labeled, ^{131}I-labeled, and unlabeled human serum albumin (HSA) were investigated. No significant differences between the three materials were observed by the agar diffusion technique or by quantitative precipitin measurements. Also the elimination patterns of the ^{125}I- and ^{131}I-labeled preparations in rabbits immunized with HSA were not significantly different. Thus, when properly prepared, radioiodinated proteins retain the immunological characteristics of native proteins and provide a valuable tool for immunologic studies. For these purposes, the ^{125}I isotope is particularly satisfactory protein label. In addition to its advantages of a relatively long half-life and a low radiation hazard to host tissues, the use of ^{125}I an immunologic label provides the opportunity to study the fate of two radioiodinated antigens in the same animal simultaneously because the γ-energy emission peaks of ^{131}I and ^{125}I are sufficiently different to permit their counting in mixtures. In this manner, the technical disadvantages associated with other isotopes which may be metabolically reincorporated by the host can be avoided. (BBB)

28017 EFFECT OF IONIZING RADIATIONS ON THE RATE OF EVOLUTION OF MURINE LEPROSY. W. A. Hadler, L. M. Ziti, and W. Becak (Universidade de Campinas and Instituto Butantan, Sao Paulo, Brazil). Intern. J. Leprosy, 32: 117-26(Apr.-June 1964).

Previous results suggest that murine leprosy, especially its rate of evolution, can be influenced by the effect of ionizing radiations. To study the eventual effect of radiations on murine leprosy, rats and mice previously subjected to ionizing radiations were inoculated with Mycobacterium lepraemurium and the evolution of the disease was followed until death of the animals. The effect of β-γ radiations from a Cs-Ba source on murine leprosy was studied after a single dose of 500 R. Histologic study showed that as a consequence of irradiation the latent phase of murine leprosy lesions became shorter and so the lesions evolved more rapidly. Correspondingly there was an increase in the rate of evolution of the disease, which was demonstrated by comparison of the mean length of survival of radiated and nonradiated animals inoculated with the same dose of bacilli. On the other hand, studies of the generation time average for M. lepraemurium, estimated from mice and rats, showed that radiation induced a striking shortening of generation time. DDS (4,4'-diaminodiphenylsulfone) treatment appeared devoid of any effect in irradiated rats. These results suggest that radiation disturbs the defense system against murine leprosy. The fact that this effect occurs in the absence of any observed alteration in the histologic structure of the murine leprosy lesions, indicated that a disturbance of the humoral defense mechanism had taken place. A defense system alteration would also account for the lack of effect of DDS in irradiated animals. (BBB)

28018 RADIATION RESISTANCE OF SOIL AZOTOBACTER. Gerard R. Vela and Orville Wyss (School of Aerospace Medicine, Brooks Air Force Base, Tex. and Univ. of Texas, Austin). J. Bacteriol., 89: 1280-5(May 1965).

Quantitative recovery of Azotobacter from soils subjected to γ radiation from a ^{60}Co source showed the soil populations to be much more highly resistant than isolates from such cultures grown on laboratory media. Even in the encysted state, the laboratory populations were reduced 10,000-fold by exposure to 200 kR, whereas the soil

populations were not measurably reduced by that dose. (auth)

28019 STUDY OF THE AMINO ACID SELECTOR SITE OF TRANSFER RNA MOLECULE BY ULTRAVIOLET IRRADIATION. Hideo Fukutome, Yoshimi Kawade, and Toshiteru Morita (Kyoto Univ.). J. Biochem. (Tokyo), 56: 492-4(Nov. 1964).

Inactivation of transfer RNA (tRNA) by uv irradiation is described as part of a study of the modification of the functional sites binding specific amino acids. Uv light of wavelength near 260 mμ selectively attacks pyrimidine bases, causing hydration of the 5,6-double bond of the pyrimidine nucleus and dimer formation between consecutive uracil residues. The cytosine photoproduct is labile and reverts to cytosine on brief heating. Therefore, if cytosine residues in tRNA undergo the same photoreaction as the monomer, it was expected that by uv irradiation (and subsequent heating) only uracil residues in tRNA would be altered. tRNA prepared from Torulopsis utilis was irradiated with the 253.7 mμ line from a germicidal lamp. To determine the time course of photolysis of uracil and cytosine residues separately, the absorbance of irradiated tRNA solutions was measured at 240, 262, 280 mμ. These wavelengths were chosen so that A_{262}-A_{280} and A_{280}-A_{240} are constant for the photoreactions of cytidylic and uridylic acids, respectively. Therefore, the changes in A_{262}-A_{280} and A_{280}-A_{240} represented the changes in uracil and cytosine residues, respectively. The survival curve of uracil residues in tRNA determined from the change of A_{262}-A_{280} was found to follow about first-order kinetics. The irradiated tRNA was assayed for its ability to accept ^{14}C-amino acids. Phenylalanine- and valine-accepting activities appeared to decrease according to the single-hit kinetics. The slopes of these curves were about twice that of the uracil survival curve determined from the absorbance change. If it is assumed that all the uracil residues have an equal probability of undergoing the photoreaction (the first-order nature of the uracil survival is consistent with this), that there are no indirect effects of irradiation on the activity of tRNA such as alteration in secondary structure, and that uracil dimer formation is not involved, then it follows that the amino acid selector sites of the phenylalanine and valine acceptor RNA contain two uracil residues. (BBB)

28020 THE ROENTGENOGRAPHIC DEVELOPMENT OF RADIOSTRONTIUM (^{90}Sr)-INDUCED OSTEOGENIC SARCOMA IN THE RAT. Thomas W. Poznanski and Sam Frankel (Jewish Hospital, St. Louis). J. Bone Joint Surg., 47A: 349-59(Mar. 1965).

Sixty rats (125-g Sprague-Dawley females) were injected with a single known carcinogenic intraperitoneal dose of 0.75 mC of ^{90}Sr per body weight. Roentgenograms of these animals were obtained at 14-day intervals (or more frequently when indicated), commencing on the 30th day, and at death of the animal when terminal roentgenograms were also made. The bone tumors encountered after a cancerogenic dose of ^{90}Sr were osteogenic sarcomas, which developed in 39 (65%) of the rats. The histological criterion for the diagnosis of osteogenic sarcoma was the presence of neoplastic osteoid forming within a sarcomatous stroma. Study of the distribution of the primary sites of the osteogenic sarcomata showed a combined percentage of 58.8 in the spinal column, followed by 28% in the long bones. In addition to the primary-site neoplasm directly responsible for the death of the animal, 18 of the 39 rats (46.1%) exhibited a total of 29 separately arising osteogenic sarcomata. The earliest time that an osteogenic sarcoma was visualized roentgenographically was 150 days after injection of ^{90}Sr, the latest, 206 days; the mean time of the first appearance was 162 days. The animals survived for a mean of 209 days after receiving radiostrontium. Osteogenic sarcomas of the long bones generally followed the appearance of a soft-tissue swelling, usually adjacent to the bone ends, with no evidence of calcification or bone involvement. Calcification of the soft-tissue mass and periosteal elevation were seen post mortem. Of the animals with osteogenic sarcoma, 64.5% had pulmonary and lymphatic metastases. Histologic patterns encountered are described. With ^{90}Sr, radiation damage to the bone is the result of the long physical half life and the high β energy produced. The maximum penetration of ^{90}Sr–^{90}Y β particles through bone is ~5.5 mm with an average range of 1.3. (TCO)

28021 ANALYSIS OF MUSCLE CONTRACTION BY ULTRAVIOLET MICROBEAM DISRUPTION OF SARCOMERE STRUCTURE. R. E. Stephens (Dartmouth Medical School, Hanover, N. H. and Marine Biological Lab., Woods Hole, Mass.). J. Cell Biol., 25: No. 2, Pt. 2, 129-39(May 1965).

In an effort to differentiate between the sliding filament theory for muscle contraction and alternative views which propose attachment between actin and myosin filaments at or across the H zone, rabbit psoas myofibrils were irradiated in various areas of the sarcomere with an ultraviolet microbeam. Irradiation of the I band appears to destroy the actin filaments; in vitro irradiation of F actin causes an irreversible depolymerization of the protein. Irradiation of the A band disorients the myosin but causes no apparent loss of dry mass. These effects are maximal at the wavelength of maximum absorption of the proteins involved. Actin filaments, released at the Z line of a sarcomere, are seen to slide into the A band on addition of ATP. Irradiation of a full A band prevents contraction, whereas irradiation of two-thirds of the A band, leaving a lateral edge intact, permits contraction at the non-irradiated edge. Thus contraction can occur in what is in essence only one-third of a sarcomere, eliminating any necessity for postulated H zone connections. These observations are in complete accord with the classical sliding filament theory but incompatible with either the contralateral filament hypothesis or the actin folding model for muscle contraction. (auth)

28022 THE FINE STRUCTURE OF ASTROCYTES IN THE CEREBRAL CORTEX AND THEIR RESPONSE TO FOCAL INJURY PRODUCED BY HEAVY IONIZING PARTICLES. David S. Maxwell and Lawrence Kruger (Univ. of California, Los Angeles and Veterans Administration Hospital, Long Beach, Calif.). J. Cell Biol., 25: No. 2, Pt. 2, 141-57(May 1965).

Normal and reactive astrocytes in the cerebral cortex of the rat were studied with the electron microscope following focal alpha particle irradiation. The presence of glycogen and approximately 60-A fibrils identify astrocyte cytoplasm in formalin-perfused tissue. The glycogen particles facilitate the identification of small processes and subpial and perivascular end-feet. Both protoplasmic and fibrous astrocytes contain cytoplasmic fibrils and should be distinguished on the basis of the configuration of their processes and their distribution. Acutely reactive astrocytes are characterized by a marked increase in the number of glycogen granules and mitochondria from the first day after irradiation. These cells later hypertrophy and accumulate lipid bodies and increased numbers of cytoplasmic fibrils. The glial scar consists of a greatly expanded volume of astrocyte cytoplasm filled with fibrils and displays no signs of astrocyte death, reversion to primitive forms, or extensive multiplication. (auth)

28023 THE EFFECT OF FRACTIONAL RADIATION ON DENTINOGENESIS IN THE RAT. William K. Collett (Univ. of Maryland, Baltimore) and John C. Thonard. J. Dental Res., 44: 84-90(Jan.-Feb. 1965).

The possibilities that rat incisors may react differently to fractional single massive radiation and that the molars, in successive developmental stages, may respond in a different pattern to the incisors were investigated. Thirty Long-Evans rats in six experimental groups were administered five fractional x-ray doses equally distributed over a 5-day period. The total air-dosage ranged from 300 to 1500 R. The 220-kv x radiation beam was directed to the top of the animal's head while the body was shielded from radiation by collimation of the primary beam and a protective lead screening apparatus. Irradiations were initiated on the 9th day post-partum and continued through the

13th day. A significant difference in the occurrence of dentinal disturbances was found at various levels of radiation dosage in both the incisors and the molars. The minimum osteodentinogenic dose in the maxillary incisors at the 60% level of occurrence was found to be 600 R (air-dose). The osteodentinogenic dose in the third molars (predentin- or nondentin-producing odontoblasts) at the 50% level of occurrence was found to be 1500 R. It was concluded that a lower minimum osteodentinogenic dose range exists than was formerly believed and that this lower fractionated dose may become increasingly important in future years. It was also concluded that odontoblastic age or stage of odontoblastic differentiation was definitely a factor in determining the reaction of these cells to fractional irradiation. The young, differentiating, but still nondentin-producing odontoblasts appeared to be the most radiosensitive cells of the developing tooth germ. (TCO)

28024 THE EFFECTS OF CONFINING CONFUSED FLOUR BEETLES IN GELATIN CAPSULES BEFORE, DURING, AND AFTER GAMMA IRRADIATION. Elvin W. Tilton, Wendell E. Burkholder, and Robert R. Cogburn (Dept. of Agriculture, Fresno, Calif.). J. Econ. Entomol., 58: 175-6(Feb. 1965).

In a study of the effects of γ irradiation on the mortality and reproduction of stored-product insects, individual insects were confined in gelatin capsules (Lilly No. 000) before irradiation, during irradiation, and in some cases throughout the post-treatment observation period. With confused flour beetles, Tribolium confusum, an experiment was designed to compare the mortality and rate of development of γ-irradiated beetles confined either in sealed gelatin capsules or in the bottom part of gelatin capsules without covers. Individual larvae, pupae, and adults of each sex, were placed in capsules 3 to 5 days before treatment with γ irradiation (17,500 rad). Observations on the mortality of the insects were made immediately after treatment, at 1, 2, 4, and 7 days after treatment, and thereafter at 7-day intervals until 42 days after treatment. The mortalities of irradiated insects in either capped or open capsules were not significantly different on a given day through 42 days, at which time complete mortality occurred. The mortality of all stages of nonirradiated insects was low, with no significant difference between the insects in capped and uncapped cages. The data indicate that there was no significant difference in mortality or rate of development between flour beetles confined in capped gelatin capsules and those confined in the uncapped bottom portion of gelatin capsules. (BBB)

28025 NOTES ON THE EFFECT OF PRECONDITIONING CONFUSED FLOUR BEETLES WITH TEMPERATURE VARIATIONS OR CARBON DIOXIDE PRIOR TO GAMMA IRRADIATION. Elvin W. Tilton, Wendell E. Burkholder, and Robert R. Cogburn (Dept. of Agriculture, Fresno, Calif.). J. Econ. Entomol., 58: 179-80(Feb. 1965).

The 7- to 9-day-old adults of Tribolium confusum were separated into 4 groups and preconditioned prior to γ irradiation. One group was held subject to the same conditions (80°F) under which the insects had been reared. Another group was held at 104°F for 24 hr, a third group was held at 50 to 55°F for 24 hr, and the remaining group was anesthetized with CO_2 for 30 min. The preconditioning treatments were timed so that each ended about 1 hr before irradiation time. The insects were treated with 17,500 Rad of γ irradiation by placing them (in their capsules) in a stainless-steel bucket and rotating them in a Ferris wheel arrangement around a 40,000°C ^{60}Co source. During the 42-day observation period, the insects were confined in gelatin capsules and were kept at 80°F. Observations were made immediately after irradiation, at 1, 2, 4, and 7 days after treatment, and thereafter at weekly intervals. None of the preconditioning treatments used had a significant effect on the mortality of the irradiated insects. All irradiated insects were dead 28 days after treatment, and all were either dead or moribund after 14 days. Mortality among the nonirradiated insects was low, and no differences caused by the preconditioning treatments were noted. It is proposed that because of the economic implications involved, the entire field of modification of the radiosensitivity of stored-grain insects should be thoroughly investigated. Studies on the use of post-irradiation treatments should be included in future research. (BBB)

28026 THE FATE AND EFFECT OF X-IRRADIATED NEUROBLASTS (PRESUMPTIVE NEURAL ECTODERM) IN A NORMAL ENVIRONMENT. Roberts Rugh and Rhoda H. Van Dyke (Columbia Univ., New York). J. Exptl. Zool., 157: 197-215(Nov. 1964).

Attempts were made to determine the fate of x-irradiated and consequently moribund neuroblast cells and their effect when placed in close proximity to similar but unirradiated neuroblast cells with which they would normally be associated. Amblystoma punctatum embryos in early developmental stages (10 to 14) were x irradiated to 250 R, and either unilateral or bilateral neural folds were transplanted to orthotopic sites of unirradiated hosts. Histologic studies were made on unilateral transplants at six-hr intervals to 84 hr, and again at stage 45 just before the larvae would normally feed. Irradiated but eventually moribund cells of the neural folds healed well in normal hosts as transplants and could not be distinguished from the normal control transplants. Within six hr of irradiation many of the transplanted neuroblast (predifferentiated neural) cells had pycnotic nuclei, never again to divide. Nevertheless, the transplanted ectodermal (neural) fold was incorporated into the body, covered by body ectoderm, and became associated with the reciprocal (contralateral) normal neural fold of the host under the ontogenetic influences which produced a semblance of a neural tube (spinal cord). There was evidence of several grades of x-ray injury to neural primordia of the spinal cord revealed by sequential study. There was immediate death with pycnosis; later (to 84 hr at least) attempted mitoses and death with pycnosis; grossly abnormal mitoses; and cells with abnormal nuclei which would probably never achieve division. Irradiated and host (normal) cells were closely intermingled at certain levels (particularly after 24 hr) and yet there was no evidence of any toxic or deleterious effect of the moribund cells on their contiguous normal host cells. Ontogenetic movements were not grossly altered but, due to the irradiation-caused deficiencies in the region of the transplant, there were displacements of the notochord, neural tube (spinal cord), somite masses, and archenteron. Cells of the dorsal and ventral cut edges of the host left neural fold moved toward the space evacuated by the excised right fold, only to be held back by the presence of the degenerating (x-irradiated) transplant, resulting in a much reduced right side with fewer cells. Permanent damage to the embryo was caused by the structural presence of irradiation-killed cells which could not be eliminated. The x-irradiation-damaged neuroblast (neural precursor) cell does not recover, and the presence of such damaged cells prevents the migration or outgrowth of normal cells from the host neural tube until such moribund cells can be eliminated. If this is not achieved by the completion of neurogenesis, that portion of the host spinal cord will be permanently deficient. Larvae having unilateral transplants of x irradiated neural fold ectoderm showed abnormal swimming movements, while bilaterally transplanted neural folds from irradiated donors prevented swimming movements altogether. (BBB)

28027 THE INFLUENCE OF PREVIOUSLY X-IRRADIATED AQUEOUS SOLUTIONS ON THE INFECTIVITY OF THE VIRUSES OF FOOT-AND-MOUTH DISEASE AND VESICULAR STOMATITIS. C. D. Johnson (Univ. of Reading, Eng.). J. Gen. Microbiol., 38: 9-19(Jan. 1965).

The inactivation of foot-and-mouth disease virus and vesicular stomatitis virus by long-lived inactivating agents in x-irradiated buffer solutions was investigated and compared with previous findings relating to the inactivation of bacteriophage by similar agents. Thus it had been shown that the inactivation of dilute suspensions of bacteriophage in pre-irradiated buffer solutions could not be attributed entirely to the action of formed H_2O_2 and that phage, irra-

diated but still infective, was more susceptible to subsequent inactivation by H_2O_2 or by pre-irradiated buffer solution. During the present investigation of the indirect action of x-irradiation on animal viruses a similar behavior was observed and the results so obtained partly explained in terms of reactions at the surface of the virus particle. Suspensions of foot-and-mouth disease virus and vesicular stomatitis virus were readily inactivated by pre-irradiated buffer solutions provided that the concentration of virus and of nonviral protein or other protective agent was sufficiently low. The same was true of the inactivation of these viruses by H_2O_2. Protein or other protective agents such as glutathione or thiourea, in the absence of any toxic effects, decreased the rate of inactivation of virus infectivity in pre-irradiated buffer solution. Rate of inactivation of the viruses in pre-irradiated buffer solutions was found to increase with the temperature of the reaction mixture and to decrease with the quantity of air or O_2 dissolved in the buffer. No inactivation was observed when buffer solution irradiated in the frozen state was thawed and used with virus at 4°C. X irradiation of the virus suspensions rendered them more susceptible to subsequent inactivation by pre-irradiated buffer solution and to the action of H_2O_2. Also pretreatment of virus suspensions with H_2O_2 rendered them more sensitive to inactivation by pre-irradiated buffer. It is evident that there are some similarities between H_2O_2 and the inactivating agents present in x-irradiated buffer solutions. One agent responsible for inactivation in the latter case may be formed H_2O_2, but there is a considerable quantitative difference between the amount of H_2O_2 formed in x-irradiated buffer solution and that which must be added to a nonirradiated buffer solution to achieve the same rate of inactivation. This difference is attributed to the presence of stabilizers in commercial preparations of H_2O_2. Possible reaction kinetics are discussed in an attempt to explain the form of the survival curves resulting from such inactivation reactions. (BBB)

28028 EFFECT OF ULTRAVIOLET RADIATION AND THE INDUCTION OF VEGETATIVE REPRODUCTION OF PHAGE LAMBDA ON THE ULTRACENTRIFUGE PATTERN OF EXTRACTS OF ESCHERICHIA COLI. B. A. Fry and J. Sykes (Sheffield Univ., Eng.). J. Gen. Microbiol., 38: 231-41(Feb. 1965).

Ultracentrifugal analysis of cell-free extracts prepared in water from unirradiated E. coli lysogenic for phage λ gave components sedimenting at 4, 8, 29, and 40S, which were obtained from the nonlysogenic parent strain. Immediately after uv irradiation (i.e. before transfer to growth medium) the ultracentrifuge pattern of extracts of the lysogenic bacteria appeared to be the same as for the unirradiated bacteria. Irradiation thus produced no immediate change. However, after uv irradiation, the growth of E. coli (nonlysogenic and lysogenic for phage λ) resulted in diminution of the 8S component of water extracts of the bacteria and the loss of its characteristic spike. In the induced lysogenic bacteria, 8S material was synthesized in the second half of the latent period and the characteristic shape of the boundary was regained. The 8S material was free DNA of relatively high molecular weight and these changes were correlated with alterations in the rate of DNA synthesis in the irradiated bacteria. The synthesis of ribosomal material was found to continue during the development of phage λ. After log phase bacteria had stood for a short time in saline, extracts prepared in tris buffer + 0.1M magnesium acetate showed that an 85S component developed. The latter was replaced by slower material (73S) when the bacteria (nonlysogenic and lysogenic, irradiated or unirradiated) resumed logarithmic growth in broth. This conversion may reflect a configurational change in the 73S component in environments which do not support growth. These experiments suggest that the induction of temperature phage development by uv irradiation of a lysogenic strain is accompanied by alterations in the RNA and DNA metabolism in the host-phage system. (BBB)

28029 SOCIAL DISTRACTIBILITY OF MALE RHESUS MONKEYS AFTER CHRONIC EXPOSURE TO FAST-NEUTRON RADIATION. A. A. McDowell and W. Lynn Brown (Univ. of Texas, Austin). J. Genet. Psychol., 106: 111-14 (Mar. 1965).

Previous studies showed a relation between amount of previous whole-body radiation exposure and disruption of free-cage behavior of adult-male rhesus monkeys, by the introduction of social stimuli. Depressed disruption occurred with increased radiation doses of mixed γ and neutron radiation. This study was conducted to determine if adult male monkeys exposed to chronic fast-neutron radiation also show a depressed social distractibility. Eleven rhesus monkeys, ranging in age from six to eight yr, were used. Five had been exposed to chronic fast-neutron radiation more than four yr earlier. They had been given a 24-hr whole-body exposure every four days at 87.2 mrep/hr until a total dose of 583 rep was achieved. The six controls had been sham-exposed during the same period. Systematic observations of free-cage behavior were examined on the basis of five behavior categories: (a) nondirected visual activity, (b) nondirected locomotor activity, (c) manual, oral, or visual response to subjects body parts, (d) manual, oral, or visual response to the cage parts as manipulanda, (e) visual response to the observer, and (f) orientational response to noises occurring outside the testroom. Each monkey was first observed with no social stimulus present, next with an adult female monkey at estimated time of ovulation present, and again with no social stimulus present. Behavioral stability was considered in terms of the maintenance (during each of the last two observations) of the balance between total directed activities and total nondirected activities, as manifest during the first observation. Total nondirected activity was used to measure that stability. The presence of the female monkey produced a marked decrease in the nondirected activities of controls, but no decrease for irradiated monkeys. The mean frequency of overt responses to the female was 11.5 for control and 6.0 for irradiated monkeys. The difference between these means is significant beyond the 0.01 level. These results are consistent with previous findings and show decreased social distractibility accruing to whole-body exposure to chronic fast-neutron radiation. These findings demonstrate long-term effects of exposure to neutron radiation, effects for which there must exist a bodily basis. (BBB)

28030 DISCRIMINATION LEARNING OF MIRRORED CUES BY NORMAL AND PREVIOUSLY IRRADIATED MALE RHESUS MONKEYS. A. A. McDowell and W. Lynn Brown (Univ. of Texas, Austin). J. Genet. Psychol., 106: 177-81(Mar. 1965).

A previous study failed to show significant differences in the capability of normal and previously irradiated female monkeys to learn to discriminate mirrored cues. In view of known differences in the learning performance of male and female rhesus monkeys, the present study was conducted to explore the capability of the male rhesus monkey to learn to discriminate mirrored cues and to assess the effect of previous exposure to chronic fast neutron radiation on that capability. Ten rhesus monkeys, ages 6 to 8 yrs, were examined, five of which had been exposed to chronic fast neutron radiation more than four yr earlier. They had been given a 24-hr whole-body exposure every four days at 87.2 mrep per hr until a total dose of 583 rep was achieved. The five controls had been sham-exposed during the same period. One monkey that failed to manifest learning was excluded from the analysis of the results on the basis of ocular differences from the other irradiated animals. Ophthalmological examination revealed that four of the irradiated subjects had posterior subcapsular cataracts centrally located in both eyes. The cataracts measured one to two mm in dia for three of these but three and one-half mm in dia for the one that was excluded. In addition, the average amount of myopia was 0.8 diopters for four of the five irradiated monkeys but was 2.25 diopters for the one with the larger cataracts. Thus, average far point of vision for four of the five irradiated monkeys was 125 cm, but it was only 44.4 cm for the remaining irradiated monkey. The testing was done in a modified version

of the Wisconsin General Test Apparatus. Monkeys were first trained to retrieve visible diced apple impaled randomly on the eye screw of one of two identical pieces of nylon cord. Next, beyond the 0.001 significance level, they learned the mirror discrimination of the baited cord from the nonbaited cord, with the irradiated monkeys learning significantly faster than the controls. Lastly, beyond the 0.001 significance level, they learned the mirror discrimination of color cues placed over the baited and nonbaited eye screws of the cords. In this instance, the groups failed to differ in learning rate. These results provide another instance of learning facilitation accruing to radiation exposure. By observing the mirrored results of their own responses, irradiated monkeys learned to discriminate faster than controls, but after learning had occurred on the initial test the groups were alike with respect to positive transfer to a second task. Learning of this type presumably reflects peripheral-cue utilization. Consequently, exposure to neutron radiation produced effects comparable with those shown on peripheral-cue discrimination learning by male monkeys exposed to nuclear radiations. In both instances, it appears that the facilitated learning rate for the irradiated monkeys was due to a decreased range of attention. (BBB)

28031 GROWTH AND DEVELOPMENT OF IRRADIATED RATS: EFFECTS OF MATERNAL AND PRENATAL GAMMA-IRRADIATION. Haley M. Jamison, R. L. Murphree, and R. S. Temple (Univ. of Tennessee, Knoxville). J. Heredity, 56: 13-17(Jan.-Feb. 1965).

The effects of irradiation on the fetuses of dams that were irradiated both prior to and during the period of gestation were studied in Sprague-Dawley rats. Four groups received the following treatments: (1) nonirradiated control, (2) irradiated 30 days before breeding, (3) irradiated on the 18th day of gestation, and (4) irradiated 30 days before breeding and again on the 18th day of gestation. Females in groups 2 and 4 were irradiated at 100 days of age. At 130 days of age, males were placed with these females. Each irradiated female received a total body air dose of 150 R γ radiation from ^{60}Co at the rate of 3.2 R/min, except the females in group 4 which received 300 R. Irradiation during gestation caused a reduction in growth rate of the offspring but irradiation of the dam prior to breeding exerted no effect on the offspring. However, combined irradiation (at 30 days before breeding and on the 18th day of gestation) produced max depression of growth. Liver, kidney, and lungs were not affected by irradiation; whereas, animals whose dams received irradiation prior to breeding and during gestation had significantly lighter brains. Animals receiving prenatal irradiation had larger hearts than those from the nonirradiated controls. Destruction of neuroblasts may have resulted in smaller brains with a thinner cortical layer although the growth curve for these tissues parallel controls. If reduction in growth rate was due to genetic damage induced by irradiation prior to conception, then there should have been some significant reduction in growth rate among the progeny of the females in treatment. Since these data show no such effect, the most logical explanation would be some type of maternal-fetal interaction. (BBB)

28032 REJECTION OF ALLOGENEIC SKIN GRAFTS AND PRODUCTION OF SPECIFIC HEMAGGLUTININS BY NONIRRADIATED AND IRRADIATED MICE SENSITIZED BY VARIOUS MEANS. Marvin L. Tyan (Karolinska Inst., Stockholm, Sweden). J. Immunol., 94: 22-30(Jan. 1965).

Studies are reported which demonstrated that in irradiated and nonirradiated mice that, of the methods used, sensitization with a skin graft or with dissociated cells incorporated in complete adjuvant induces the most vigorous, persistent, and radioresistant homograft sensitivity and secondary hemagglutinin response. Male and female (C57B1 × CBA) F_1 ($H\text{-}2^b - H\text{-}2^k$) mice were sensitized with tissue from female A/Sn ($H\text{-}2^a$) mice. Skin graft donors were female (C57B1 × CBA)F_1, A/Sn and the isogenic resistant line A.CA. One week after the last injection (i.e., on day 0) the mice were either grafted with syngeneic, A/Sn and A.CA skin or they received 630 rad whole body x irradiation and were grafted immediately thereafter. Sensitization by means of a skin graft induced pronounced and radioresistant homograft sensitivity toward both H-2 and non-H-2 antigens. While sensitization with A/Sn spleen cells incorporated in Freund's complete adjuvant was equally effective with regard to A/Sn grafts, this method produced a less radioresistant response toward the H-2-alleles and non-H-2 antigens which A.CA shares with A/Sn. In nonirradiated mice subcutaneous injection of spleen cells alone appeared to induce little or no homograft sensitivity; however, the response proved to be moderately radioresistant. In nonirradiated mice the injection of spleen cells and adjuvant in separate sites produced a vigorous sensitization to subsequent specific grafts; but only when the antigen and adjuvant were injected into sites having a common lymph node drainage did the sensitivity prove radioresistant. (BBB)

28033 PHOTO-HEMOLYSIS ASSOCIATED WITH PROTOPORPHYRINEMIA: PRELIMINARY REPORT. Leonard C. Harber, Alan Fleischer, and Rudolf L. Baer (New York Univ., New York). J. Invest. Dermatol., 42: 483-5(June 1964).

In vitro hemolysis of red blood cells by u-v light was studied using cells from a patient having erythropoietic protoporphyrinemia. In the patient, a seven-yr-old girl who has vesicular and crusted skin lesions on the light exposed areas, erythrocyte protoporphyrin blood levels were significantly elevated. The effects of u-v light on the patient's red blood cells and on the red blood cells of a normal control subject were compared. Blacklight fluorescent tubes with emission spectrum mainly between 3200 and 4500 Å were used. The results of the hemolysis studies using the spectrophotometric technic showed abnormal hemolysis in the patient's specimen on each of four occasions. There appeared to be a direct correlation between the length of irradiation and the degree of hemolysis. In all reported cases of erythropoietic protoporphyria the abnormal photosensitivity is associated with elevated erythrocytic protoporphyrin levels. Present findings of red blood cell hemolysis reinforce the concept that the protoporphyrin molecule is a strong photosensitizer capable of damaging or destroying human cells in which a sufficient concentration of uv light and protoporphyrin are brought together. In view of the very fast and pronounced in vitro hemolysis, it is note-worthy clinically that the patient manifested vesicular and crusted lesions and not purpuric ones. The most likely explanation is that the protoporphyrin molecule which is known to be present in the serum is also present in the epidermis and cutis. Consequently, the photosensitizing action may produce damage to these cutaneous cells and lead to the changes seen. (BBB)

28034 THE EPIDEMIOLOGY OF LEUKEMIA. William L. Jackson (Univ. Hospitals, Iowa City, Iowa). J. Lancet, 85: 25-9(Jan. 1965).

A summary of general epidemiological studies on human leukemia is presented. Radiation has been shown capable of producing leukemia in humans with both whole-body, single exposures, and with small multiple exposures. At least for whole-body exposure the dose-induction potential is a linear function. Evidence relating to leukemia incidence in Japanese atomic bombing survivors, radiologists, and therapeutically irradiated persons was surveyed. It has been pointed out that the young may be considerably more sensitive to radiation than adults, and it has been estimated that the fetal tissues may have a susceptibility to radiation damage 8 times that of adult tissues. Several estimates of dose-response relations exist for cumulative radiation effect. For small multiple doses the threshold for radiation induction is probably in the range of 500 Rad. Estimates are made of how much human leukemia radiation is responsible for. It has been postulated that radiation damage operates by one of two mechanisms. There can be a direct effect on the cell altering its genetic make-up or

reducing its resistance to infection, or by increasing any instability in the cell-multiplication process radiation only enhances the probability of an occurrence that could have happened without radiation. (TCO)

28035 EFFECTS OF DISINTEGRATION OF INCORPORATED ^{32}P IN ASPERGILLUS NIDULANS. P. Strigini, C. Rossi, and G. Sermonti (Instituto Superiore di Sanita, Rome). J. Mol. Biol., 7: 683-99(Dec. 1963).

The mutagenic and lethal effect of ^{32}P was studied in a mold with uninucleated conidiospores and with a haploid and a diploid phase. Decay of incorporated ^{32}P in haploid spores of Aspergillus caused a constant inactivation rate, with a lethal efficiency $\alpha = 0.018$. Reduction of P concentration in the medium under a critical value produced a decrease of non-DNA P in the spores with consequent increase of α at the same specific activity of P. Practically all the lethal as well as the mutagenic effect may be attributed to transmutations in DNA-^{32}P. The mutation rate (resistance to 8-azaguanine or p-fluorophenylalanine) increased exponentially with the increase of fraction of ^{32}P decayed. This increased mutability was partly inheritable, and also manifested as an enhanced sensitivity to the mutagenic effect of uv rays. Lethal efficiency of ^{32}P in diploid spores was very low when decay begins and increased with progress of decay up to values comparable to the efficiency in haploid spores. Somatic segregation was induced by ^{32}P decay in diploid spores through a stage of mitotic instability. The lethal efficiency of assimilated ^{32}P was much higher than that of x rays or particles from external ^{32}P. Dwarf colonies morphologically similar to those observed after ^{32}P decay were also induced by x and β radiation; their frequency, however, relative to normal survivors, was much lower. They were not studied for their spontaneous segregation rate. (BBB)

28036 THE X-RAY MENOPAUSE IN 267 CASES. Diana Brinkley, J. L. Haybittle, and D. S. Murrell (Addenbrooke's Hospital, Cambridge, Eng.). J. Obstet. Gynaecol. Brit. Commonwealth, 70: 1010-15(Dec. 1963).

A follow-up study was made of 267 cases of menorrhagia treated by deep x rays between 1942 and 1952, in an attempt to assess the success of the treatment to determine what conditions developed later which might be related to the menorrhagia or to the x-ray treatment. In particular the number of cancers was noted and attempts made to assess if this group of patients has the same rate of cancer development as a comparable section of the population. The standard treatment was given with 220-kvp x rays, through anterior and posterior fields of 20 × 10 cm, which delivered a dose of 700 R centrally in two treatments over five days. The treatment was regarded as successful if bleeding stopped within six months. There was a failure rate of 5.3%. X-ray menopause did not aggravate existing hypertension, nor did the treatment seem to have produced hypertension in patients whose blood pressure was normal before treatment. Although the number (8) of pelvic cancers, particularly of cervix and corpus uterus, was greater than expected, the differences were not significant. The evidence from this series does not therefore confirm the findings of Corscaden et al., that subsequent to radiotherapeutic menopause, carcinoma of the uterus occurs ~3.4 times as frequently as in the general population. Differences are pointed out between this series and that of Corscaden et al. In the latter, some cases were treated by Ra, and of the 15 cases of subsequent uterine cancer only six had received an x-ray menopause. If radiotherapeutic menopause induces cancer at all, then since Ra treatment gives a much higher dose to the wall of the uterine cavity, it is more likely to be carcinogenic than an x-ray treatment. The results showed that x-ray induced menopause is a simple and safe treatment which was successful in 253 out of 267 cases. There was no mortality and no serious morbidity associated with the treatment. If further information is to be obtained on the incidence of pelvic cancer subsequent to the x-ray menopause, it is important for all patients to have a dilatation and curettage and a cervical biopsy before any x-ray treatment is given. In this way early carcinoma of the cervix may be detected, which might otherwise appear later and be attributed to the treatment. (BBB)

28037 EXPERIENCE WITH FINGER FILM DOSIMETRY IN WORK WITH IONIZING RADIATIONS. S. K. Stephenson (Christie Hospital and Holt Radium Inst., Manchester, Eng.). J. Phot. Sci., 12: 91-5(Mar.-Apr. 1964).

In medical and lab work involving handling of radioactive sources, radiation exposure to the fingers of a worker is often considerably greater than that to his trunk or, even, his wrists. In diagnostic radiology, especially involving palpation of the patient during the examination, finger exposure may present a significant special hazard to the operator. It therefore is important to measure finger doses during the course of certain procedures. An account is given of the construction and uses of home-made film packs suitable for mounting on the fingertips of persons who handle radioactive sources or palpate patients during x-ray fluoroscopic procedures. Various types of film, cut to 1-cm squares, are used in these light-tight, waterproof packages. The calibration and interpretation of films exposed to various types and qualities of ionizing radiation are discussed and some examples are given of typical results obtained. Calibrations are made by exposing complete finger packs sandwiched between 4-mm thick sheets of plastic (to provide secondary electron equilibrium) to known γ-ray exposures from a 100 mg Ra source at a distance of the order of 30 cm. Under these conditions, a calibration exposure of 1 R of γ radiation corresponds to an absorbed dose of 0.96 rad in tissue from similar radiation. When finger packs are used in work with x rays generated at voltages from 35 to 150 kvp, a single calibration with x rays generated at about 100 kvp will usually suffice. Finger doses of the order of 5 rad have been measured during a single operation in which the surgeon had to insert a large number of Ra sources into a patient. The first and second fingers, often of the left hand for a right-handed worker, frequently show the largest exposures. (BBB)

28038 POSTIRRADIATION SARCOMAS. R. S. Rao (Tata Memorial Hospital, Bombay). J. Postgraduate Med. (Bombay), 10: 54-7(Apr. 1964).

Four cases of sarcomas attributed to previous ionizing irradiation are described in detail and discussed in terms of previously reported cases. The first case had received 6300 R of 140-kv x rays for a buccal squamous cell carcinoma, which then completely regressed. Seven yr later a fibrosarcoma was seen in the irradiated zone. In case 2, that of a 12-yr-old girl, a clinical diagnosis of cavernous hemangioma of the heel was made and the lesion was given a dose of 1200 R by a 140-kv machine. Seven yr after the conclusion of radiotherapy it was found that she had a large bulky tumor over the calacaneum, very vascular and involving the bone, and histologically an undifferentiated fibrosarcoma. In case 3, a 17-yr-old male with a swelling in the neck diagnosed as Hodgkin's disease was given deep x rays to the neck with a 200-kv machine to a tumor dose of 3200 R. There was complete regression of the lymph glands, but nearly 6½ yr after the previous treatment a swelling in the irradiated field below the angle of the mandible developed. This was considered as a recurrence of the disease and treated with deep x rays again to a dose of 2538 R. There was no response to irradiation and further irradiation was considered inadvisable as the area had been irradiated previously. The swelling when excised revealed the structure of fibrosarcoma, with no evidence of Hodgkin's disease. The fourth patient was a four-yr-old boy who was first seen with a swelling of the lower end of femur diagnosed as Ewing sarcoma. He was treated with deep x rays to a dose of 2050 R with a 200-kv machine. There was complete regression of the tumor, but after 6 yr the boy showed what was thought to be a local recurrence. The limb was amputated and showed a chondrosarcoma, with no evidence of Ewing tumor in the specimen. A notable feature of these and other cases is that there was a prolonged latent period following irradiation. It usually varies from 3 to 20 yr, average 6 yr. Soft tissue sarcomas

have all been fibrosarcomas, and no other soft tissue sarcomas arising from muscle, nerve, or lymphoid tissue have been reported so far. These fibrosarcomas have occurred in some cases following irradiation for a variety of benign conditions such as hypertrichiosis, hyperthyroidism, tuberculous adenitis, keloids, and scars. (BBB)

28039 BIOLOGICAL SIGNIFICANCE OF PIGMENTS OF MYCOBACTERIA. I. ARTIFICIAL INDUCTION OF PIGMENTLESS MUTANTS FROM PHOTOCHROMOGENS AND SCOTOCHROMOGENS BY ULTRAVIOLET IRRADIATION. II. CORRELATION OF PIGMENT FORMATION WITH THE VIRULENCE. Sumio Tsukamura (Obuso National Sanatorium, Obu, Japan). Japan. J. Tuberc., 12: 1-6(July 1964).

Ultraviolet radioinduced mutations of Mycobacterium kansasii and M. bovis are reported. After uv irradiation, pigmentless mutant colonies could be found among many yellow or orange colonies of the photochromogens (M. kansasii) and soctochromogens (M. bovis), although spontaneous pigmentless mutant could not be found among 1000 to 2000 colonies. The ratio of pigmentless colonies per the total colonies (= mutation frequency) differed from strain to strain. It appeared that there was a marked difference in the mutation frequency between the photochromogens and the scotochromogens. Pigmentless mutants induced by uv irradiation appeared among photochromogens at the rate of 0.5 to 1.4%, whereas such mutants appeared among scotochromogens at the rate of 0.09 to 0.19%. Accordingly, the mutation frequency to pigmentless mutants of the photochromogens was 3 to 14 times higher than that of the scotochromogens. These results suggest that uv light penetrated the cells of the photochromogens more easily, or that the photochromogens retain a more complex genetic system than the scotochromogens. The virulence of these mutant strains was not so different among each other, but they were more virulent than the BCG strain. The photosynthetic capacity of the pigments was not correlated to the virulence. (BBB)

28040 ENDOREDUPLICATION IN LEUKOCYTE CHROMOSOMES: PRELIMINARY REPORT OF ITS RELATION TO CANCER AND WHOLE-BODY IRRADIATION. Ben I. Friedman, Eugene L. Saenger, and Michael S. Kreindler (Univ. of Cincinnati). Lancet, 1: 494-5(Sept. 5, 1964).

Endoreduplication is a form of polyploidization characterized by diplochromosomes in prophase and metaphase. It is a type of internal doubling, single or multiple, of the chromosomes and has been reported previously in leucocyte cultures of patients with leukemia. In chromosome preparations from 11 patients with cancer an increased frequency of endoreduplication was seen after whole-body irradiation. Cobalt-60 γ radiation was given at a focus-skin distance of 282 cm to the midline, using two lateral portals at an air exposure dose rate of 4 to 5 R/min with an estimated absorbed dose of 100 to 150 rad. Half of the dose was administered through each side. Leucocyte cultures were obtained before whole-body irradiation and at varying times afterwards. One patient who had received 100 mC of ^{131}I seven months earlier was studied immediately before and after a second dose of 100 mC of ^{131}I. Chromosome preparations were examined for endoreduplication; in 4 its frequency per mitosing cell was calculated. Endoreduplication was present in all 11 patients, and was observed after counting fewer than 1400 cells in 3 out of 4 patients who had had no previous irradiation or chemotherapy. In 4 out of 5 selected controls it was not seen. Endoreduplication was present in the first 48 hr after irradiation. These data suggest that endoreduplication in peripheral blood studies may be associated with either irradiation or the presence of malignancy. If endoreduplication occurs more often in patients with disseminated cancer, then it may be related not only to the presence but also to the extent of disease. Additional studies of normal controls of varying ages and of patients with varying extent of malignancy are being made. (BBB)

28041 STIMULATION OF DPN TURNOVER IN ASCITES TUMOR CELLS BY LOW X-RAY DOSES. H. Hilz, J. Rueter, M. Oldekop and I. Wueppen (Universitat, Hamburg). Life Sci., 4: 765-9(Apr. 1965).

Immediate effects of x rays on diphosphopyridine nucleotide (DPN) content and on DNA synthesis (thymidine incorporation) of ascites tumor cells were seen only with fairly high doses and mostly above those required for inhibition of cell proliferation. In some strains this discrepancy was very pronounced, and in the sensitive Ehrlich ascites carcinoma used, irradiation with 1000 R (and higher) caused a dose-dependent inhibition of DNA synthesis and, to a similar degree, a rapid fall in DPN content. This fall is probably due to a loss of intracellular nicotinamide resulting in a de-inhibition of the DPN glycohydrolase (DPNase). Additional results pointed to the importance of an adequate level of nicotinamide for the metabolism of ascites tumor cells. Thus when Ehrlich ascites tumor cells were irradiated with 500 to 1000 R and transplanted into mice, the cell yield after six days decreased with increasing doses. Based on cell volume, these cells showed an increased inhibition of DNA synthesis, and to a lesser degree a fall in DPN content. In addition, there was a striking increase in the capacity of these cells to incorporate labeled nicotinamide indicating a strongly activated DPN turnover. Both DPN and DNA contents were higher than normal in the 500-R group and fell more pronounced in the 1000-R group. Inhibition of DNA synthesis (thymidine incorporation) after 500 R was negligible and drops to about 16% after 1000 R. In contrast, nicotinic acid incorporation and DPNase activity were stimulated about threefold after 500 R reaching a tenfold higher level after 1000 R on the per cell basis. (TCO)

28042 THE INFLUENCE OF RADIOTOXINS ON THE INTRAUTERINE DEVELOPMENT OF THE FETUS. Endre Czeizel, Kalman Majorossy, Miklos Keresztes, and Akos Goergenyi (Orvostudomanyi Egyetem, Budapest). Magy. Radiol., 16: 355-8(Dec. 1964). (In Hungarian)

Experiments were conducted to determine the influence of x irradiation and radiotoxins on the intrauterine development of the rat fetus at various stages of gestation. One group of female rats received 500 R whole-body irradiation with 180-kv x rays 1.5 days after fertilization, which reduced the percentage of pregnant animals from 56.3% to 21.4%, and the number of young from 8.7 to 4.0 per litter. Shielding of the uterus increased the number of pregnancies in irradiated animals to 35% and the number of young to 5.6. When 500 R whole-body irradiation was given on the 10.5th day of gestation the number of pregnant animals was 75% in the control group, 66.6% in the irradiated group, and 80% with shielding; the number of young were 9.2, 5.8, and 8.3 respectively; the average weights of fetuses in the three groups were 3.34, 0.12, and 1.65 g. Analysis indicated that irradiation just before implantation reduced the number of pregnancies as well as the number of living young considerably. Irradiation at the time of organogenesis influenced the weight of the fetus, the number of young per mother, and caused craniocerebral abnormalities in the young. Lead shielding of the uterus caused only quantitative differences. The second series of tests were conducted to determine the effects of single and repeated injections of 1000 R irradiated bone marrow suspension and spleen suspension. One injection of irradiated bone marrow suspension caused no changes. Repeated injections in the preimplantation period decreased the number of pregnant animals slightly, but not significantly. The number of pregnancies also decreased slightly when irradiated spleen suspension was injected; and when normal bone marrow suspension was injected. These two suspensions did not influence the number and weight of the young. Irradiated bone marrow suspension given repeatedly in the early stages of pregnancy decreased the number of young significantly. Repeated injections of irradiated bone marrow suspension during the period of organogenesis decreased the weight of the young slightly, but developmental disorders were not observed. It is apparent that radiotoxins, present in irradiated bone marrow and spleen, have no significant effects on the development of the fetus, and that the placental barrier screens

any direct effects of such toxins from the fetus so that only the secondary effects caused by them on the metabolism of the mother can affect the fetus. Only direct irradiation of the fetus has an adverse effect on its development. (BBB)

28043 RESPIRATORY PATTERN OF CERTAIN RESPIRATORY ENZYMES AND ENZYMES OF KREBS' CYCLE IN NORMAL AND IRRADIATED RAT LIVER. A. Notario, G. Slaviero, G. Doneda, and G. Santagati (Universita, Pavia, Italy). Minerva Nucl., 9: 79-83(Mar.-Apr. 1965). (In Italian)

A study was made of the respiratory pattern exhibited by the anaerobic glycolysis of certain enzymes of the respiratory chain and of Krebs' cycle in the liver of normal rats and of rats given a single dose of 500 or 1,000 R. The findings were as follows: the irradiated livers showed a fall in oxygen consumption over a given period of time; little change in the CO_2/O_2 ratio; a simultaneous reduction in anaerobic glycolysis; and condensing enzyme activity and in TPNH- and DPNH-cytochrome-c-reductase. Other enzymes, such as cytochrome oxidase, aconitase and oxalosuccinic decarboxylase remained almost unchanged; while malic dehydrogenase, succinic dehydrogenase, fumarase and α-ketoglutaric dehydrogenase were increased to a variable degree. The findings are briefly discussed. (auth)

28044 BEHAVIOUR OF SOME ENZYME ACTIONS OF ANAEROBIC GLYCOLYSIS AND OF THE DIRECT OXIDATIVE GLUCOSE WAY (HEXOSE SHUNT) IN THE HEPATIC TISSUE OF NORMAL AND IRRADIATED RATS. A. Notario, G. E. Slaviero, and G. Santagati (Universita, Pavia, Italy). Minerva Nucl., 9: 84-7(Mar.-Apr. 1965). (In Italian)

An investigation was made of the behavior of the following enzymatic actions in the livers of normal rats and rats panirradiated with 500 and 1000 R in a single session: phosphofructoaldolase, glyceraldehyde-3-phosphate dehydrogenase, pyruvicokinase, lactic dehydrogenase, glucose-6-phosphoglucosico-dehydrogenase, transketolase, and glutathione reductase. The main alterations seen were a notable drop in pyruvicokinase action after panirradiation with 1000 R with a slight simultaneous increase in glucose-6-phosphate dehydrogenase and transketolase action. The other enzyme actions examined showed inconstant variations of little importance. The results are discussed briefly. (auth)

28045 THE ROLE OF RADIATION ON EXPERIMENTAL LEUKEMOGENESIS. Henry S. Kaplan (Stanford Univ., Palo Alto, Calif.). Natl. Cancer Inst. Monograph, 14: 207-20(May 1964).

Mouse experiments are considered which show that radiation induces lymphosarcomas in the C57BL and other strains by an indirect mechanism, whereby tumors develop in nonirradiated thymus glands grafted to pre-irradiated hosts. Cell-free extracts from such radiation-induced lymphosarcomas, inoculated into nonirradiated newborn isologous mice, elicited identical tumors with significantly increased incidence, and the activity of the agent in the cell-free extracts increased after serial passage, which suggests that a virus or virus-like agent mediates the actual neoplastic induction in irradiated mice. Serial passage data are reported and evidence is presented that radiation produces three simultaneous effects, all of which are essential to the induction process: (1) injury to the normal sites of storage of the latent virus, with concomitant release of virus; (2) injury to the thymus, followed by regeneration; (3) injury to the bone marrow, which in turn interferes with the regeneration of the irradiated thymus, producing maturation arrest in which large numbers of highly immature lymphoid cells are made available for a sustained period for the oncogenic expression of the virus. The nature of the stimulus to regeneration of the injured thymus is unknown, but it is influenced by endocrine factors. Thus the adrenocortical steroids and testosterone, which are strongly thymolytic, powerfully inhibit lymphoma development in irradiated C57BL mice, whereas adrenalectomy and orchiectomy increase the yield of these tumors, the increase being greater in the former case than in the latter, in keeping with their relative thymotropic potencies. The radiation-involuted thymus is unable to respond to the tropic stimulus of adrenalectomy unless the bone marrow is shielded. Thus, there is a sustained disturbance by irradiation of a complex and dynamic tissue equilibrium in which endocrine balance, bone marrow radiation injury, and availability of free virus appear to be vectors. (BBB)

28046 OBSERVATIONS ON POSSIBLE MECHANISMS OF LEUKEMIA INDUCTION IN MAN FOLLOWING RADIATION EXPOSURE. W. M. Court Brown (Western General Hospital, Edinburgh). Natl. Cancer Inst. Monograph, 14: 291-300(May 1964).

Studies of the mortality from leukemia in heavily irradiated human populations are discussed in the light of possible mechanisms of radiation leukemogenesis. Account is also taken of newer knowledge from human cytogenetics, particularly in regard to the finding of a specific chromosome abnormality in most cases of chronic myeloid leukemia and the persistence for many years of chromosome abnormalities produced by in vivo radiation exposure in man and as seen in blood cultures. Experience now shows that all cases of leukemia occurring in an exposed population cannot be considered strictly on the basis that they are due to a single event produced by radiation on the genome of the cell. If radiation-induced chromosome damage is solely responsible for the development of chronic myeloid leukemia, then present cytogenetic knowledge about this disease indicates that it cannot be assumed to be induced by a single event; there must be at least two events. The role of the Ph^1 chromosome in the induction of chronic myeloid leukemia is considered. Cytogenetically there appears to be no difference between cases of chronic myeloid leukemia not thought to be radiation-induced and those considered to have a high probability of being so induced, from the study of a limited number of cases. One argument presented is that radiation induces the disease by causing a deletion of material from the long arm of a small acrocentric autosome, thought to be a member of pair 21, following the production of two breaks. This deletion in some way puts the cell and its progeny at an advantage to normal diploid cells in the marrow, so that there is a steady and eventually complete replacement of the normal by the abnormal, and this affects the three major cell lines in the marrow. It appears that: (1) A number of different agents may produce the same type of chromosome abnormality as x rays; (2) there may either be sites of predilection on the chromosomes for such damage, or, alternatively, if the damage is random certain forms are more compatible with survival than others. Three ways are proposed whereby radiation and viruses may have a coleukemogenic effect. Radiation may act by producing a cell line of such an altered genotype that the cells are sensitive to transformation by a pre-existing and apparently harmless virus. Another possibility arises from the observation that total-body exposure in combination with the polyoma agent produced salivary gland tumors in adult mice whereas neither agent alone was effective. Such an effect presumably could depend on the production of cells of an altered genotype, but it could also depend on the modifications by radiation of immune responses. Thirdly, radiation may act directly on a pre-existing virus so that it became capable of transforming either normal cells or cells, the genotype of which had been altered by radiation. (BBB)

28047 POST-IRRADIATION RECOVERY OF E. COLI 'B' AFTER X- AND α-IRRADIATION IN OXYGEN OR NITROGEN. V. P. Paribok, E. A. Valdstein, and V. D. Zhestjanikov (Inst. of Cytology, Leningrad). Nature, 206: 525-6(May 1, 1965).

Post-irradiation recovery of E. coli B x- or α-irradiated was compared under aerobic and anaerobic conditions. Irradiated bacteria were plated on complete meat peptons agar and minimal medium. Survival was determined by the number of macrocolonies after 24 to 48 hrs. Recovery was always les after irradiation in air than in anoxic conditions. It is suggested that in E. coli B the re-

producing system is affected according to the single-hit principle, whereas the recovery system is damaged according to the multi-hit system. Thus the oxygen effect reflects chiefly the degree of damage of the recovery system and shows the extent of all recovery in the given experimental conditions. (H.G.D.)

28048 FATTY ACID OXIDATION IN IRRADIATED BONE MARROW CELLS. Fred Snyder (Oak Ridge Inst. of Nuclear Studies, Tenn.). Nature, 206: 733(May 15, 1965).

Rats were killed by decapitation at 1, 2, 9, 16, and 55 days after receiving whole-body ^{137}Cs irradiation of 100, 300, and 800 R at approximately 4 R/min. The results of studies on femur bone marrow demonstrated that whole-body irradiation significantly inhibits the oxidation of palmitic-1-^{14}C acid in marrow cells. As little as 100 R caused fatty acid oxidation to be inhibited; as long as 55 days after the irradiation exposure, the bone marrow oxidized the fatty acid at only one-half the normal rate. The largest degree of inhibition by 800 R occurred 1 day after exposure. The accumulation of triglycerides in irradiated marrow appears to be explained by increased biosynthesis of fatty acid esters and inhibition of fatty acid oxidation. (P.C.H.)

28049 THE INFLUENCE OF THE EHRLICH'S ASCITES TUMOR ON THE REGENERATION OF HEMATOPOIESIS IN IRRADIATED MICE. V. Juraskova, L. Thadlecek, and V. Drasil (Biophysical Inst., Czechoslovak Academy of Sciences, Brno). Neoplasma, 11: 591-8(1964).

The possibility of metabolic alterations caused by growth of Ehrlich ascites tumor (EAT) cells on bone marrow regeneration after whole-body x irradiation was investigated in H strain mice. In mice irradiated with a dose of 550 R, 5 to 7 days after irradiation a greater number of leukocytes in the peripheral blood was found when the mice were inoculated intraperitoneally with 4.8×10^6 EAT cells 2 days after irradiation. In the bone marrow of these mice signs of earlier regeneration of hematopoiesis, when compared with the irradiated controls, were seen. The presence of undamaged cells in the peritoneum of mice irradiated with 650 R increased the number of colonies of the regenerating hematopoietic cells in the spleen. Hematopoiesis was stimulated also by EAT cells irradiated with a dose of 10,000 rad when injected into a host at a dose of $1\text{-}2 \times 10^8$ cells/mouse. When the suspension of EAT was irradiated with a dose of 30,000 rad, the number of colonies in the spleens of mice having this irradiated tumor did not differ from that of the irradiated controls. Histological examination of the colonies of the regenerating hematopoietic cells in the spleen of irradiated mice with EAT showed that both red and the white cell hematopoiesis was stimulated. It appears that the action of the inoculated tumor is not manifested only by the aggravation of postirradiation anemia and by the increased level of erythropoietins. (BBB)

28050 RISING INCIDENCE OF HYPOTHYROIDISM AFTER RADIOACTIVE-IODINE THERAPY IN THYROTOXICOSIS. John T. Dunn and Earle M. Chapman (Massachusetts General Hospital, Boston). New Engl. J. Med., 271: 1037-42(Nov. 12, 1964).

A long-term follow-up study of 1452 patients treated with ^{131}I or with ^{130}I is presented. The incidence of hypothyroidism was 26% in the ^{131}I-treated patients and rose to 43% when patients were followed for more than ten years. The incidence was 44% in the ^{130}I-treated group. Hypothyroidism increased at a steady rate of 2% for those given ^{131}I and of 2.9% for those given ^{130}I. In each group the rate was constant after the second year and showed no diminution by the 15th year of follow-up study. Factors associated with the induction of hypothyroidism are analyzed. The incidence of hypothyroidism is higher than generally recognized, and this constitutes the major undesired effect of radioiodine therapy. Ways of meeting this problem are discussed. One way is to recognize the features associated with the development of hypothyroidism and to vary the treatment dose accordingly. The basic dose of 100 mC retained per estimated g of thyroid tissue can be increased for elderly patients and those with nodular goiter or severe chronic disease, and decreased for younger patients and those with previous thyroid surgery. Another possibility is to lower the dose of radioiodine in all patients. This would presumably lengthen the time necessary for effective control of hyperthyroidism by a single dose and would increase the need for multiple doses. (BBB)

28051 EXTRACORPOREAL IRRADIATION OF BLOOD AND LYMPH IN ANIMALS: ITS EFFECT ON HOMOGRAFTS AND ON LYMPHOMA. E. P. Cronkite, A. D. Chanana, and Hp. Schanppauf (Brookhaven National Lab., Upton, N. Y.). New Engl. J. Med., 272: 456-61(Mar. 4, 1965).

Results on modification of the homograft response and lymphomatous processes in cattle, the blood of which was subjected to extracorporeal irradiation are reported. Lymphopenia was produced by different transit doses and schedules of extracorporeal irradiation, which produced degrees of lymphopenia equivalent to or greater and more prolonged than the lymphopenia following thoracic-duct drainage. It was anticipated that calves depleted of lymphocytes by extracorporeal irradiation of blood would accept homografts for prolonged periods. Homografts were obtained from donor calves from unrelated animals of the same or different strains of calves. Recipients were identical twins, dizygotic natural chimeras, or single animals. In the animals depleted of lymphocytes the rejection process was mild, as compared to the violent rejection in the control animals with a normal complement of lymphocytes. During the 14-day period the output of lymphocytes in the duct dropped by a factor of 10, and the blood small lymphocytes fell to about 200 per mm^3 by the 17th day after the cannulation. On the 14th day homografts were placed on a lymphocyte-depleted animal and its twin. The twin rejected the graft between the ninth and the 12th day, but in the depleted calf no evidence of rejection was seen until the 36th day. The effect of extracorporeal irradiation on bovine leukemia and lymphoma was also investigated. In normal animals continuous extracorporeal irradiation resulted in progressive lymphopenia. After six to 12 hr a new steady-state level of lymphocytes was established in the blood, apparently maintained as a result of a balance between the rate of killing cells and a nonsteady-state depletion of lymphocyte stores throughout the body. In the leukemic animal it took 18 hr of extracorporeal irradiation to attain the initial minimum level of small lymphocytes in the blood. With the second course of irradiation it took 12 hr to attain the minimum level. (TCO)

28052 EFFECTS OF X RAYS ON EXPERIMENTAL LUNG TUMORS. I. 1000-R IRRADIATION IN ANIMALS INTRANASALLY INOCULATED WITH YOSHIDA SARCOMA. Teruhiko Shinohara (Tohoku Univ., Sendai). Nippon Igaku Hoshasen Gakkai Zasshi, 24: 351-61(July 1964). (In Japanese)

About 5×10^6 Yoshida sarcoma ascites cells were inhaled pernasally into the lungs of Donryu strain rats, and the animals' chests were irradiated five days after inoculation with 1000 R, 180-kv x rays, the rest of the body being shielded with two mm of lead. Three animals were killed at each interval varying from 15 min to 10 days after irradiation, and the lungs and lymph nodes were examined histologically. The results showed that a decrease of mitotic rate began to occur shortly after irradiation, while the degenerative and destructive changes in tumor tissue occurred later and reached a maximum one to two days after irradiation. Radiation-induced damage of the cells, however, was less evident in the lung tumors than in the ascites form of the same tumor cells. The changes of metastatic tumor cells in the hilar lymph nodes showed almost the same features seen in the primary lung tumors. Radiation-induced injury was more markedly manifested in the normal tissue cells such as the lymphocytes than in tumor cells metastasizing into the hilar lymph nodes, and the dominant growth of tumor cells was observed in the irradiated lymph nodes. The histologic changes were most pronounced one to two days after irradiation, the time at

which mitotic rate was showing progressive increase, reaching a normal level by the 6th day post-irradiation. (BBB)

28053 PRESENT STATUS OF SOMATIC EFFECTS IN ATOMIC BOMB SURVIVORS LIVING IN HIROSHIMA. Susumu Watanabe (Hiroshima Univ.). Nippon Ketsueki Gakkai Zasshi, 27: 121-30(June 1964). (In Japanese)

During the past 18 years, 303 cases of leukemia occurred in Hiroshima; 190 cases in people who were exposed to the atomic bomb within the distance of 5000 m from the hypocenter. Total incidence of leukemia per 100,000 per yr was 4.79, whereas that of exposed cases was 10.84. All cases of death from leukemia were 275, including 174 exposed cases. Total death rate of leukemia per 100,000 per year was 4.22, whereas that of exposed cases was 9.98. The death rate of leukemia in Hiroshima was about 2.1 times, while the death rate among the exposed cases was about 4.8 times that of all Japan. However, there has been a gradual decline in the incidence and death rate of leukemia among the survivors in recent years. A survey on hematological findings was performed in seven consecutive years starting in 1952 on people who had been uniformly exposed to atomic radiation on a street about 2300 m away from the hypocenter and were exposed to the so-called black rain that was heavily contaminated with radioactive fission products. In the first year, there was a mild orthochromic anemia; however, improvement in erythrocytopoiesis occurred and it reached a normal level (with slight anemia) by 1958. Hyperchromic anemia was demonstrated in 1955 in 4.4%, whereas in 1958 it was 2.5%, indicating a gradual decline of the hyperchromic anemia in these exposed individuals. Incidence of malignant tumors in persons exposed within the distance of 1000 m from hypocenter reached about four times of that of nonexposed cases. Incidence of malignant tumors of stomach, lung, breast, and ovary among persons exposed within 1500 m increased with significant difference as compared with that of nonexposed cases. There was a correlation between incidence of myelofibrosis and distance from the hypocenter and the incidence of this disease in exposed persons was about five times more frequent than in nonexposed persons, and 18 times more frequent than the mean value for all Japan. (BBB)

28054 MULTIPLE CHROMOSOMIC ANOMALIES OBSERVED IN THE COURSE OF A HEMOPATHY ON A SUBJECT OCCUPATIONALLY SUBMITTED TO IONIZING RADIATIONS. J. Ruffie, R. Bierme, A. M. Salles-Mourlan, and P. Colombies (C. H. U. de Purpane, Toulouse). Nouvelle Rev. Franc. Hematol., 4: 551-6(July-Aug. 1964). (In French)

Ten years after a radiologist quit work because of radiodermatitis of the hand, he developed moderate anemia, thrombopenia, and moderate leucocytosis. Bone marrow and blood samples were taken from the patient and cultured. From the cultures 217 photographs of mitoses were obtained and analyzed. There were 170 normal karyotypes, 11 incomplete or noninterpretable karyotypes, and 36 karyotypes clearly presenting anomalies. Of the 36, 34 had karyotypes of 46 chromosomes. Of these, 26 had a missing normal chromosome replaced by an aberrant one. Eight karyotypes had modified chromosomes. The usual modification was a decrease in size, probably due to deletion of the short arms. This was observed once on a chromosome of pair seven, twice on a chromosome of pair nine, and three times on a chromosome of pair 12. The other two cells had a karyotype of 47 chromosomes, with a chromosome increase in pairs 19 and 20 and a loss of one chromosome from pair six. These multiple chromosomic anomalies were not of the types encountered in malignant hemopathies, but were similar to those appearing in certain cancers or in normal cells irradiated in vitro. (BBB)

28055 CONCERNING THE MECHANISM OF LYMPHOID RADIOLEUKEMOGENESIS IN THE MOUSE. J. F. Duplan and R. Latarjet (Universite, Paris). Nouvelle Rev. Franc. Hematol., 4: 5-10(1964). (In French)

Viruses have been shown to be responsible for spontaneous leukemogenesis in mice. In radioleukemogenesis the type and role of the virus are not clear. Irradiation might act on an inactive virus in the cells, but this is improbable. X rays could fragment the virus, releasing a cancerogenic agent. Or, the virus might exist in the cells as a provirus, producing active virus under the influence of radiation. It is possible that the provirus is localized in cells which are not of the lymphoidal or granular line. In mice which underwent a thymectomy and received injections of virus, myeloidal leukemias appeared, seemingly caused by the same virus as lymphoidal radioleukemias. Assuming viruses preexist in the cells in an active form, the cells they exist in could not be those they would change into leukemic cells. The virus would be released by the cells, but could be neutralized by antibodies before reaching sensitive cells. There is experimental evidence which both supports and contradicts this thesis. It is more likely that antibodies are formed against the transformed (leukemogenic) cells than against the leukemogenic virus. Irradiation, by decreasing the antibody concentration, frees the leukemogenic cells from this repressive factor. Such antibody- transformed cell relations are known to exist. All of these explanations still contradict or leave unexplained some experimental facts. Another hypothesis is that x rays increase the number of cells sensitive to virus. Actually, irradiation destroys most of the thymic cells. This destruction provokes a hypersecretion of lymphotropic hormones which over-stimulate the division of the surviving thymic cells. The possibility of cancer increases greatly. The hormonal imbalance can be corrected only by a thymectomy or an injection of isologous hemopoietic cells. (BBB)

28056 PLASMA CELL PROLIFERATION IN THE THYMOLYMPHATIC ORGANS OF ALBINO RATS AFTER TOTAL-BODY X IRRADIATION. Kazuhiko Awaya, Hajime Fujii, Masayoshi Oda, Hiromu Hori, and Tatsuya Kijima (Yamaguchi Medical School, Ube, Japan). Okajima Folia Anat. Japon., 39: 263-70(Jan. 1964).

Male albino rats of the Wistar strain, about four months old, were given a single dose of 600 R whole-body x irradiation with a deep therapy (160-kv) machine at a dose rate of 18.94 R per min. The rats were sacrificed one to 30 days after irradiation, and the thymus, mesenteric lymph nodes, and spleen were studied after hematoxylin and eosin staining. In the thymus, within 24 hr after irradiation the destruction of cortical lymphocytes had occurred, with only a few surviving lymphocytes in the medulla. Between the third and 10th days after irradiation, the shrinkage of thymus continued and the connective tissue proliferation became prominent. From the 10th day on, repopulation with lymphocytes, which proceeds slowly outwards from the medulla, was observed. In mesenteric lymph nodes, irradiation produced massive destruction of lymphocytes. The damage was particularly severe in the secondary nodules, resulting in a nodule-free period until about 7 days after irradiation, when new nodules began to appear. At this stage, a few immature secondary nodules consisting of medium-sized lymphocytes in mitosis occurred in the cortical area. These grew rapidly in size and number from the 14th postirradiation day on and in 30 days resembled the typical secondary nodules in the control animals. Irradiation resulted in a marked increase of plasma cells. The occurrence of plasma cells rose from the base line figure of 0.23% to 1.8–28.7% in the cortex and from 46.7% to 51.2–86.4% in the medullary cords. This plasma cell proliferation reached its maximum on the third day in the cortex and 10th day in the medullary cords. By this time, most of the medullary cords were occupied by plasma cell nests. In spleen, depletion of white pulp with a decrease in the size of the organ as a whole was evident following an irradiation. The regenerative process of the secondary nodules in the white pulp was the same as in the mesenteric lymph nodes. In all the organs studied, there was a marked increase in the absolute number of plasma cells except in the thymus, in spite of a marked decrease in the total number of nucleated cells in these organs. (BBB)

28057 INHIBITION OF TUMOR GROWTH IN THE RAT BY IRRADIATION AND AN ANTIMETABOLITE.

R. Ghys, Y. Roy, and A. Reuter (Universite Laval, Ste-Foy, Can.). Oncologia, 18: 43-56(1964). (In French)

The combined effect of radiotherapy and chemotherapy on the growth of tumor FM55, a grafted fibrosarcoma, was studied in male Sprague-Dawley rats. In the appropriate strain of rats, this tumor grows very regularly and it provides an excellent medium to study antitumor therapeutic measures. The rate of growth of the tumor was shown to drop by more than 40% after injections of an unnatural amino acid, 1-amino cyclopentane carboxylic acid (ACPC). However this effect was manifested only with toxic doses of the drug and on small-volume tumors. A single irradiation of the tumor with 5000-R doses of 200-kv x rays caused complete regression of small tumors. Weak tumor inhibition was obtained with 2000 R and a more marked effect with 3000-R doses. A 4000-R dose strongly inhibited tumor growth and produced radiodermatitis with epilation and dry desquamation. Thus Sarcoma FM55 is fairly radiosensitive. A combined treatment by ACPC injections and 4000-R x irradiation gave an inhibition of tumor growth which was only equivalent to radiotherapy alone. It is concluded that ACPC acts as an antimetabolite; it has no specific antineoplastic or radiosensitizing action on this type of tumor. Since it acts nonselectively on dividing cells, normal and malignant, its use may be contraindicated in humans undergoing radiotherapy. (BBB)

28058 THE ACTION OF STRONG DOSES OF X RAYS ON BLOOD COAGULATION FACTORS: PRELIMINARY THROMBODYNAMOGRAPHIC STUDY OF PLASMA IRRADIATED IN VITRO. M. Suscillon, D. Holland, and R. Rinaldi (Institut des Isotopes Radio-Actifs, Laboratoire de Radiobiologie du C.E.N.G. and Laboratoire d'Hematologi du C.H.U., Grenoble, France). Pathol. Biol. Semaine Hop., 11: 1023-7(1963). (In French)

Plasma was exposed to soft x-ray doses of $2 \cdot 10^5$ to $16 \cdot 10^5$ R. Thrombelastographic tracings were made of each sample, irradiated or control. The value of the longitudinal constant r (in mm) was 15 to 17 for all controls. The value of r varied from 16 for $2 \cdot 10^5$ R to 95.5 for $15 \cdot 10^5$ R. For larger doses of irradiation, the value of R was ∞. The longitudinal constant k (in mm) was 5.5 to seven for the controls. The value increased as the irradiation dose increased, ranging from six for $2.5 \cdot 10^5$ R to 120 for $14 \cdot 10^5$ R. With larger doses, k's value was ∞. The increase in the values of r and k represented an inhibition of the activation factors of thrombin. The value of the transverse constant Emx (in mm) was 225 to 260 for the controls. The value decreased from 212 for $2.5 \cdot 10^5$ R to zero for $16 \cdot 10^5$ R. This decrease represented a weakening of the dynamic properties of the coagulum. Plotting the values of r and k on a semilogarithmic graph, it was discovered the values formed a slightly ascending line for the doses $2 \cdot 10^5$ to $11 \cdot 10^5$. This line represented the progressive modification of the initial processes of coagulation. The values of r and k increased greatly from $11 \cdot 10^5$ to $16.5 \cdot 10^5$ R, forming a sharply ascending curve on the graph. This curve, most likely, represented the rapid denaturation of fibrinogen. (BBB)

28059 EFFECT OF GAMMA RADIATION ON RATE OF ETHYLENE AND CARBON DIOXIDE EVOLUTION BY LEMON FRUIT. E. C. Maxie, I. L. Eaks, N. F. Sommer, Henry L. Rae, and Salah El-Batal (Univ. of California, Davis). Plant Physiol., 40: 407-9(May 1965).

Gamma radiation induces sufficient production of ethylene gas by lemon fruits (Citrus limon) to cause degreening of the fruit. The rate of respiration of irradiated lemon fruit increases immediately after treatment. After a few days the increase is followed by a decline, giving a curve resembling the autogenous climateric common to many fruits, but atypical for citrus. The production of ethylene follows the same general pattern as the respiration rate, but reaches a peak 1 or 2 days later. (auth)

28060 THE UV-INDUCED TRIPLET STATE IN DNA. R. O. Rahn, R. G. Shulman, and J. W. Longworth (Bell Telephone Labs., Murray Hill, N. J.). Proc. Natl. Acad. Sci. U. S., 53: 893-6(May 1965).

Evidence from ESR and optical emission studies, which shows that the observed emission from uv irradiated DNA is from the thymine moieties, is presented. Because thymine only phosphoresces when it loses its N_1 proton ($pK = 9.8$), the results are consistent with an effective transfer of the proton from thymine to adenine during emission. All measurements were made at 77°K on samples dissolved in a 1:1 ethylene glycol-water glass. Concentrations used for making optical measurements were in the range 10^{-3}-10^{-4} M. For ESR measurements the concentrations ranged from 3×10^{-4} to 3×10^{-2} M. (P.C.H.)

28061 PYRIMIDINE DIMERS IN UV-IRRADIATED POLY dI:dC. R. B. Setlow, W. L. Carrier, and F. J. Bollum (Oak Ridge National Lab., Tenn.). Proc. Natl. Acad. Sci. U. S., 53: 1111-18(May 1965).

The effects of uv radiation on the ordered polynucleotide dI:dC were investigated by absorption spectroscopy and by chromatographic analysis of hydrolysates of the irradiated polymers. Dimers between adjacent cytosine residues were identified as stable photoproducts. They deaminate slowly (50% in 2 hr at 37°C) to uracil dimers. Cytosine dimers are formed at lower rates than thymine dimers between adjacent thymine residues, but they are monomerized at more rapid rates by short-wavelength radiation than thymine or uracil dimers. The photoreactivating enzyme from yeast in the presence of visible light can monomerize cytosine and uracil dimers as well as thymine dimers. The production of uracil from cytosine by uv irradiation at 280 mμ takes place at about one fiftieth the rate of production of cytosine dimers. (auth)

28062 MUTAGENESIS IN RELATION TO GENETIC HAZARDS IN MAN. O. G. Fahmy and Myrtle J. Fahmy (Chester Beatty Research Inst., London). Proc. Roy. Soc. Med., 57: 646-50(July 1964).

Experimental data are used as a basis for assessing the comparative genetic hazards to man of mutagenic chemicals and ionizing radiations. The mutagenic activity of alkylating compounds was compared to that of radiation on the basis of the efficiency of both classes of agents in the induction of sex-linked recessive lethals in the fruit fly. A standard volume (0.3 μl/fly) of a given drug concentration (usually about 10^{-2}M) was injected into the hemocoel of males (200 to 500 per test) around the testes, and their sperm was then tested for sex-linked recessive lethals. Comparable males were exposed to a measured dose of radiation and their progeny also scored for the same mutations. It was thus possible to determine the concentration of the injected compound which induced the same mutation rate as a given dose of radiation. This analysis revealed that all the alkylating compounds tested were mutagenic to various degrees. The highest mutagenicity occurred with triethylenemelamine which at a concentration of 4×10^{-4}M induced a mutation rate equivalent to 6000 R, while the lowest activity occurred with ethylene oxide which at a concentration of 10^{-2}M induced a mutation rate equivalent to about 30 R. The natural macromolecules tested were ineffective in the induction of sex-linked recessive lethals, but were most active in the induction of chromosome deficiencies resulting in the Minute phenotype. Homologous DNA at a concentration of 1% induced chromosome deficiencies at a rate equivalent to 3000 R, while RNA at the same concentration had one-fifth the activity of DNA. Histones had double the activity of DNA. Sex-linked recessive lethals increased linearly with dose, while major chromosome rearrangements increased in proportion to the square of the dose for the alkylating agent triethylenemelamine. There is apparently no threshold effect for mutagenesis, either with radiation or with the alkylating mutagens, thus justifying extrapolation (towards zero dose) for the estimation of genetic damage at low doses. It was demonstrated that the mutation rate per locus in Drosophila shows marked variation to the same mutagen and that the same genes respond differently to different mutagens. When the same nine loci were exposed to mutagenically equivalent doses of x rays and melphalan, no response occurred with radiation, whereas each locus mutated at least once with the chemical agent. An investigation was also

undertaken of the frequency of recurrence of the same sex-linked recessive visible per thousand recessive mutants (visibles and lethals) induced in the X chromosome with x rays and alkylating mutagens. The distribution of these recurrences for 70 loci along the X chromosome were very different between the agents. The loci of high mutability with each agent (the so-called hot spots) were identified as those which gave a significantly higher frequency of recurrence than the average for the same loci with all agents. Conversely, the relatively refractory loci were those that gave a significantly lower rate of recurrence than the mean. The distribution of the hot spots was very different for the various mutagens, thus demonstrating the significance of gene/mutagen interaction to the mutational process. Some aspects of the mutation load in man and the concept doubling dose are discussed in terms of these experimental results. The only estimate for the doubling dose available for mammals is based on the radiation-induced mutation rate at seven loci in the mouse, where exposure to 35 R per generation doubles the average spontaneous rate per locus. When this dose is extrapolated to man, it can be estimated that after exposure to 35 R the human mutation rate is increased from 0.2 to 0.4 mutant per offspring, which means the addition of one mutation per five individuals above the spontaneous rate. This increase in the mutation load would result in an additional genetic extinction per 200 individuals in the generation following the doubling exposure. If the average exposure is 175 R per individual, one induced mutation would occur per offspring, which would increase genetic extinctions in the generation after exposure to one individual in 40. A table gives detailed estimates for human exposure to radiation over a 30-yr reproductive generation. The total (about 8 R) only accounts for less than a quarter of the spontaneous mutation rate (the equivalent of which is produced by 35 R). It is suggested that the major proportion of this rate (three-quarters) must be of chemical origin. Another table shows the physical doses of various chemical compounds which are mutagenically equivalent to the total exposure to radiation over a full reproductive generation, as well as to the estimated human doubling dose (35 R). Hazards associated with the use of these compounds (for example, as drugs and insecticides) are discussed. (BBB)

28063 PITUITARY IMPLANTATION OF RADIOACTIVE ISOTOPES FOR MEDICAL DISEASES. Murray A. Falconer (Guy's Hospital, London). Proc. Roy. Soc. Med., 58: 62-3(Jan. 1965).

The effectiveness of implantation of radioisotopes into the pituitary for acromegaly, Cushing's syndrome, and diabetes mellitus, compared with neurosurgical treatment, is assessed, along with the side-effects and risks involved. When there is an extrasellar extension of a pituitary tumor, the best treatment is usually a neurosurgical approach supplemented by external radiation. These extensions vary in their direction, size, and in the symptoms which they cause. The extrasellar extensions of eosinophilic tumors may be large, producing various patterns of visual failure from optic nerve, chiasmal, or tract compression. Generally, large extensions cannot be adequately corrected by implantation of radioactive Au or Y seeds within the pituitary fossa or even by the transnasal surgical removal through the floor of the pituitary fossa. There is a risk that a transient swelling of the gland may result from external radiation and precipitate a further decline in vision before a therapeutic shrinkage of the gland is obtained. Again, with high doses of supervoltage therapy, cases of delayed radiation necrosis of the brain are still encountered. Radiation should, therefore, be employed as an adjunct to surgery for suprasellar extensions and not as a substitute. However, destruction of the pituitary gland either completely or partially for some medical condition, such as the endocrine effects of pituitary tumors or diabetic retinitis, is a very different problem from the treatment of extensions of pituitary tumors. Deliberate destruction of the pituitary gland can be undertaken by several routes and techniques, which are described. Patients after surgical hypophysectomy subsequently require permanent hormonal replacement therapy with cortisone and thyroid. The same need for replacement therapy also occurs after pituitary function has been destroyed completely by radioactive implantations. However, using appropriate precautions a partial destruction of the pituitary gland can be produced by pituitary implantation of ^{90}Y and ^{198}Au, and in suitable cases the endocrine features of acromegaly and the retinal changes of diabetes mellitus can be mitigated without rendering the patients impotent or amenorrhoeic, or condemning them to a life-long dependence upon regular cortisone and thyroid substitution therapy. There are, however, risks inherent in the transnasal implantation of radioactive materials into the pituitary gland. Experience of treating such complications in patients referred from other hospitals is described in terms of three types: (1) hemorrhage into the pituitary gland, (2) cerebrospinal rhinorrhea and meningitis, (3) delayed cranial nerve palsies, particularly of the optic nerve and the VI cranial nerve. Hemorrhage into a pituitary tumor was encountered twice after pituitary implantation. In one patient insertion of the cannula into the gland caused bleeding which led to blindness with severe headache. In the second case the implantation produced within a few hours an almost complete bilateral ophthalmoplegia, but complete spontaneous recovery occurred in both cases. A case with VI cranial nerve palsy appeared a year after implantation. An empty sellar cavity was found and no evidence of extension of the tumor; possibly delayed radiation necrosis was responsible for this lesion. It is concluded that transnasal implantation of radioactive materials has its hazards, but as these appear to be infrequent, the method of treatment justifies a longer trial. (BBB)

28064 THE EFFECT OF X-IRRADIATION ON RENAL DAMAGE SECONDARY TO ISCHEMIA. J. U. Schlegel and A. K. Gup (Tulane Univ., New Orleans). Proc. Soc. Exptl. Biol. Med., 119: 14-16(May 1965).

On the basis of the results obtained, it appears reasonable to suggest that the effect of radiation in modifying acute rejection is possibly secondary to its effect upon ischemia. Whatever the mechanism may be, it appears that a small amount of radiation has a beneficial effect upon the kidney damaged by anoxia, a finding which may have therapeutic value in a variety of conditions. (auth)

28065 EFFECT OF SHORT-TERM ALPHA IRRADIATION ON PARATHYROID ACTIVITY AND OSTEOCLAST NUMBERS. S. B. Doty, C. W. Yates, W. E. Lotz, W. Kisecleski, and R. V. Talmage (Argonne National Lab., Ill. and Atomic Energy Commission, Washington, D. C.). Proc. Soc. Exptl. Biol. Med., 119: 77-81(May 1965).

A study of the distribution of ^{239}Pu in bone, and its effects on bone cells was presented and correlated with endogenous parathyroid activity. There was no measurable effect on the function of existing osteoblasts or osteoclasts during this short term (5 day) experiment. Also, incorporation of Pu into osteoclasts did not disrupt the ability of parathyroid hormone to maintain normal Ca levels. However, it could be demonstrated that Pu, for the first 48 hrs after administration, affected certain of the undifferentiated bone cells, which in turn prevented the increased osteoclast production normally seen following endogenous parathyroid stimulation. (auth)

28066 EVIDENCE FOR THE PRESENCE OF STEM CELLS IN THE TAIL OF THE MOUSE. C. V. Robinson, S. L. Commerford, and J. L. Bateman (Brookhaven National Lab., Upton, N. Y.). Proc. Soc. Exptl. Biol. Med., 119: 222-6(May 1965).

In experiments in which the tails of mice were shielded during exposure to x rays, colonization of the spleen occurred in excess of that found in whole-body irradiated control animals. This was the case whether the measure of effect was post-irradiative gain in spleen weight, uptake of IDU 5-iodo-2′-deoxyuridine (IDU), or nodule count. The degree of colonization was found to be a function of the length of time which elapsed between the original irradiation (with tail shielded) and a subsequent, suppressive irradiation of the tail. Histological examination showed

that the spleen nodules were hemopoietic, and that normal tail vertebrae contained hemopoietic tissue. (auth)

28067 THE ACUTE LEUKAEMIAS: A STUDY OF 580 PATIENTS. Stuart Roath, M. C. G. Israels, and John F. Wilkinson (Royal Infirmary, Manchester, Eng.). Quart. J. Med., 33: 257-83(Apr. 1964).

A study of 580 patients with acute leukemia was made; they were all seen at the Manchester Royal Infirmary within the last 30 yr. Family history, previous illnesses, occupation, and exposure to radiation were among the etiological factors considered of importance, and an attempt was made to assess these. Only three subjects had unequivocal cases of leukemia in their families. Twenty-two patients had either parents or siblings with malignant disease. Congenital abnormalities were found in four patients only; one mongol, one mental defective, one with congenital heart disease, and one patient with cranial synostosis who had also had much exposure to diagnostic x rays. Details of previous illnesses included almost every type of illness, although there was no preponderance of blood diseases (only five cases even of iron deficiency, two of polycythemia vera, and two of pernicious anemia). Surprisingly, there were 10 patients who gave a history of malaria. Only one radiation worker presented with acute leukemia of the myelogenous type, diagnosed by routine blood count. Many male adults were connected with heavy chemical industries, but a wide spectrum of manufacturing processes from metals to solvents was found, and such an occupation is common in the surrounding industrial area. A positive history of therapeutic radiation, usually, though not always for malignancy, was found in nine patients. This exposure had occurred two to eight years previously and was directed at various sites, including the whole spine in one patient with rheumatoid spondylitis. Two were irradiated for undiagnosed lung tumors, and one for Hodgkin's disease; all these subjects had acute myelogenous, reticulum-cell, or privitive types of leukemia. Three additional patients might also have received unusually large amounts of diagnostic radiation. This incidence supports the relation between therapeutic radiation and acute leukemia suggested previously by Court Brown. However, the small number of subjects with a background of medical radiation exposure does not correlate well with the experience of others. Neither exposure to shoe-fitting x rays, nor fetal or childhood irradiation could be etiologically implicated in these subjects. Exposure to drugs occurred often during what appeared to be the prodromal symptoms of acute leukemia, which made their assessment as causal agents unlikely. It is concluded that etiologies of acute leukemia remain obscure, and the data presented give little support to any particular one of the current speculations concerning this disease. (BBB)

28068 THE RADIATION DOSE ACCUMULATED BY BLOOD DURING EXTRACORPOREAL IRRADIATION. George Marsaglia (Univ. of Washington, Seattle and Boeing Scientific Research Labs., Seattle), and E. Donnall Thomas. Radiation Res., 25: 269-76(June 1965).

A mathematical formula is presented for determining the probability distribution of the number of times that a blood cell passes through a shunt. Applications in the dosimetry of extracorporeal blood irradiation are discussed. For practical purposes, any one of the methods for computing the distribution of radiation dose, the exact probability method, the method based on differential equations, or the normal approximation, is likely to be more precise than the other data associated with the shunting procedure, particularly estimates of total blood volume, flow through, and transit time of the shunt. The advantage of the normal approximation lies in the speed and simplicity of the calculations; a little arithmetic to find the mean and standard deviation will serve in most situations to describe adequately the distribution of the radiation dose by means of the normal curve. The advantage of the probability approach, in general, is its adaptability to modifications of the initial assumptions. The normal approximation is relatively insensitive to the actual distribution of the stay of a blood cell in the main circulation, depending only on the mean and variance. It is not difficult to modify the theory to take into account other situations, for example, when treatments are intermittent, spread over enough time that changes in the cell population become significant, or when assuming more than one body compartment, with specified initial distributions of cells. (auth)

28069 EFFECTS OF PROLONGED LOW-LEVEL IRRADIATION OF MICE. Leo K. Bustad (General Electric Co., Richland, Wash. and Univ. of Washington, Seattle), Noel M. Gates, Alan Ross, and Loren D. Carlson. Radiation Res., 25: 318-30(June 1965).

Hybrid male mice (C57BL × 101) were exposed for 8 hours daily from age 6 to 58 weeks to either 0.1 R/hr or 0.2 R/hr of γ irradiation and then maintained for their normal life span. The average life expectancy for the two subgroups exposed to 0.1 R/hr was 857 and 870 days, compared with 879 and 966 days for their controls, and for the two subgroups exposed to 0.2 R/hr it was 856 and 894 days, compared with 922 and 918 days for their controls. Growth rates were slightly higher for the irradiated mice than for their controls. The incidence of gross abnormalities was higher in the control subgroups than in the irradiated subgroups at 20 months. No significant increase in tumor incidence was observed in the irradiated groups. Although the dose levels used in these experiments resulted in consistent small differences in patterns of longevity and growth between the averages for the irradiated and control mice, the differences in most instances were small relative to normal experimental variation. (auth)

28070 MODIFICATIONS OF PRODUCTIVITY IN FLOUR BEETLES, TRIBOLIUM CASTANEUM HERBST, DUE TO X-RAY DOSE, HYPOTHERMIA AND THE SEX EXPOSED. Howard E. Erdman (Battelle Northwest, Richland, Wash.). Radiation Res., 25: 341-51(June 1965).

Day-old virgin flour beetles, T. castaneum, were x irradiated with 0, 500, 1000, 2000, or 4000 R. Ten replicates each of control, male-exposed, female-exposed, and both-exposed mating combinations were established at 25°C, 29°C, and 32°C in 65 to 70% relative humidity. Daily for 2 weeks each pair was given 5 gm of acclimated food. The day of reproductive onset, the number of fertile pairs, and the number of F_1 adults were used as measures of productivity. Data are summarized and the modifications of the three parameters investigated for productivity are discussed from the standpoints of temperature effects and dose effects on the degree of development and differentiation of male and female germ cells. The dose-response curves were the multihit type, implicating chromosomal aberrations as the cause of altered productivity. (auth)

28071 RADIATION RESPONSE OF MAMMALIAN CELLS GROWN IN CULTURE. V. TEMPERATURE DEPENDENCE OF THE REPAIR OF X-RAY DAMAGE IN SURVIVING CELLS (AEROBIC AND HYPOXIC). M. M. Elkind, H. Sutton-Gilbert, W. B. Moses, T. Alescio, and R. W. Swain (National Cancer Inst., Bethesda, Md.). Radiation Res., 25: 359-76(June 1965).

The two-dose fractionation survival response of aerobic and hypoxic Chinese hamster cells at reduced temperatures is compared to their response at 37°C. At reduced temperatures which strongly impede cell progression processes (growth and division), repair of sublethal x ray damage is only weakly affected. These studies indicate that the fractionated dose response at an optimal growth temperature results from the concomitant processes of repair of damage plus progression of cells. (auth)

28072 THE EFFECT OF 2-Mev WHOLE-BODY X-IRRADIATION ON PRIMATES. Glenn V. Dalrymple, Ian R. Lindsay, and John J. Ghidoni (School of Aerospace Medicine, Brooks AFB, Tex.). Radiation Res., 25: 377-400 (June 1965).

One hundred and four primates (Macaca mulatta) were irradiated with graded single exposures of 2-Mev x rays; an $LD_{50(30)}$ of 670 ± 20 (S.E.) rads was estimated. Hematological studies performed over a 90-day postirradiation period revealed no essential difference from previously described results. Serum lactic dehydrogenase (LDH) lev-

els were significantly increased during the first 4 post-irradiation days, but they subsequently returned to normal ranges by the seventh day. Alkaline phosphatase and leucine aminopeptidase levels were unchanged over the 90-day observation period. Clinical changes occurring during the postirradiation period were characteristic of the hematological type of death, with the exception of a single animal that died a typical gastrointestinal death. Examination of tissues obtained at postmortem strongly suggests that sepsis was the immediate cause of death. (auth)

28073 COMPARISON OF THE EFFECTS OF SOME RADIATION MODIFIERS ON SELECTED RADIOMIMETIC AGENTS IN MICROORGANISMS. Robert F. Pittillo, Annie Jo Narkates, and James Burns (Southern Research Inst., Birmingham, Ala.). Radiation Res., 25: 401-9(June 1965).

A group of radiomimetic agents were compared for inhibitory action on a group of nonproliferating microörganisms. Radiation modifiers, both radiation protectors and radiation potentiators, were evaluated for effects on selected radiomimetic agents using E. coli ATCC 9637 as the indicator system. Biological data are presented which suggest that the action of azaserine more closely approximates that of ionizing irradiation than do the actions of the other radiomimetic agents studied. (auth)

28074 LEUKEMIA IN THE RHESUS MONKEY (MACACA MULATTA) EXPOSED TO WHOLE-BODY NEUTRON IRRADIATION. R. Zalusky, J. J. Ghidoni, J. McKinley, T. P. Leffingwell, and G. S. Melville (School of Aerospace Medicine, Brooks AFB, Tex.). Radiation Res., 25: 410-16(June 1965).

A case is reported of myelocytic leukemia occurring in a rhesus (Macaca mulatta) monkey after exposure to whole-body neutron radiation. Whether the neutron irradiation was of etiologic significance naturally remains questionable. Four other male monkeys, exposed under the same conditions, showed no evidence of white blood cell abnormalities either on peripheral blood or on bone marrow preparations. Certain features of the leukemia in this monkey are noteworthy when comparison is made to currently available information on the disease in human beings exposed to ionizing radiation in Hiroshima and Nagasaki. Granulocytic leukemia has been the predominant form, and the peak incidence occurred between four and eight years after exposure. Although the animal in this report was exposed to fractionated doses of neutron irradiation, the total cumulative dose was in the range of peak leukemia incidence. (auth)

28075 EFFECT OF LOCALIZED IRRADIATION ON THE METABOLISM OF BONE-MARROW LIPIDS. Fred Snyder and Reba Wright (Oak Ridge Inst. of Nuclear Studies, Tenn.). Radiation Res., 25: 417-22(June 1965).

Studies of lipocyte formation in bone marrow of rats after γ irradiation showed that only the marrow directly exposed to the field of irradiation becomes fatty. The esterification of 1-^{14}C-palmitic and 1-^{14}C-stearic acids into triglycerides was markedly elevated at the irradiated marrow site as early as 24 hours after exposure, but irradiation did not increase the incorporation of 1-^{14}C-oleic acid into bone marrow triglycerides. (auth)

28076 EFFECT OF PATERNAL (SPERMATOGONIAL) X-RAY EXPOSURE IN THE MOUSE: LIFE SPAN, X-RAY TOLERANCE, AND TUMOR INCIDENCE OF THE PROGENY. Henry I. Kohn, Mary L. Epling, Paul H. Guttman, and Donald W. Bailey (Univ. of California, San Francisco). Radiation Res., 25: 423-34(June 1965).

To evaluate the genetic effects of spermatogonial irradiation, CAF_1 males 9 months of age or older were irradiated with 250 kvcp x rays (whole or partial body; 40 rads/min; 0 to 720 rads). Six or more months later they were mated with unirradiated BALB/c females. The 3000 progeny weaned at 35 days of age were studied with respect to tumor incidence and age at death. The x ray tolerance (500 rads/week) at about 2 years of age was determined in 168 of the progeny. No significant effect of paternal irradiation was found. For future experiments, a working estimate of the change in life span after such paternal exposure is: male progeny, –7 days per 100 rads; females, +2 days per 100 rads. Very large scale experiments will be needed to establish such differences. The analysis of variance of life span showed a significant difference between breedings and between cages. The relatively large effects due to breedings emphasize the need to repeat experiments of this type which estimate marginal differences. Although the cage effect was small, it is suggested that the mean life span per cage rather than per animal is the statistically valid unit. A significant difference due to fractionation (2 × 248 versus 496 rads; 3 × 240 versus 720 rads) or to integral dose (whole-body versus partial-body exposure) was not observed, nor was a significant change in tumor incidence or in radiation resistance. (auth)

28077 EXPECTED RELATIVE BIOLOGICAL EFFECTIVENESS OF RADIATION AND A METHOD FOR DETERMINING IT. M. Zel'chinskii (Joint Inst. for Nuclear Research, Dubna, USSR). Radiobiologiya, 5: 161-5 (1965). (In Russian)

The ICRP recommended RBE values are discussed and methods for determining the RBE are discussed. (IIC-M.G.)

28078 IMMUNOLOGICAL RESPONSE IN RABBITS TO ANTIGEN INJECTED AFTER X IRRADIATION (ON STUDY OF THE DYNAMICS OF APPEARANCE AND MORPHOLOGY OF CELL WITH ANTIGENS BY MEANS OF "INDIRECT METHODS" BY KUNS). PART II. K. A. Lebedev (Inst. of Epidemiology and Microbiology, Moscow). Radiobiologiya, 5: 237-42(1965). (In Russian)

Whole-body x irradiation of rabbits with 300 and 850 R on the day before the first or third immunization with diphtheria antitoxin significantly decreased the antibody synthesis, the decrease at the first immune response being greater than anamnestic. Preliminary irradiation before the second immunization significantly decreased the antibody-synthesizing cells. The appearance of the maximum number of antibody-containing cells was delayed and their residence time in the lymph nodes was lengthened. In rabbits irradiated before immunization, the antibody-producing cells found were hemocytoblasts and plasma and lymphocyte-like cells. Sometimes the antibody-containing reticular cells were activated. Degenerative changes occurred in the nuclei and protoplasm of all types of cells, and localizations and intensities of luminescence were unusual. The percentages of young forms containing antibodies decreased earlier after irradiation but later were normal compared to nonirradiated immunized rabbits. (tr-auth)

28079 CHROMOSOME BREAKAGE IN SOME CELL GENERATIONS IN IRRADIATED MISGURNUS FETUSES. N. V. Pankova (Inst. of Biological Physics, Moscow). Radiobiologiya, 5: 248-52(1965). (In Russian)

Numerous chromosome aberrations were observed in cells of Misgurnus fossilis roe that went through more than 10 divisions after irradiation. Along with bridge fragments, in the blastula and gastrula cells there were pure fragments formed as a result of breaking of newly formed chromosomes. The fraction of cells with aberrations and the severity of the damage were greater in the gastrula cells than in the blastula. (tr-auth)

28080 X-RAY INFLUENCE ON SURVIVAL AND MUTAGENIC PROCESS IN CHLORELLA. V. A. Shevchenko (Inst. of Biological Physics, Moscow). Radiobiologiya, 5: 253-9(1965). (In Russian)

In studies on Chlorella, the exponential nature of the dose-effect curves indicated that the strains studied are haploid. The amount of induced mutations varied linearly with dose. The spectrum of the mutations differed from that of spontaneous mutations. Genetic analysis of segmented pigment mutations showed that these can be used to evaluate the state of the genetic material at the time of irradiation. (tr-auth)

28081 MORPHOLOGICAL CHANGES IN MOUSE LIVER INDUCED BY IRRADIATION WITH FAST NEUTRONS. A. F. Ivanitskaya (A. N. Severtsov Inst. of Ani-

mal Morphology, Moscow). Radiobiologiya, 5: 260-4 (1965). (In Russian)

Fast-neutron irradiation caused changes in the liver parenchyma, Kupfer cells, and vascular system. Vacuoles formed in the cytoplasm, giant nuclei formed, the number of binucleated cells increased, the nucleoli increased in size and number, and the syncytial structure of the Kupfer cells was damaged. Changes in the vascular system were expressed as hyperemia and dilatation of the sinuses and vessels, infiltration of the liver parenchyma with blood, and accumulation of white cells along the vessels. Changes in the liver were similar to those resulting from x irradiation. However, the absence of large necrotic areas after a lethal dose of fast neutrons, although present after x irradiation, indicates that whole-body irradiation with fast neutrons damages the liver less than x irradiation. (tr-auth)

28082 CYTOCHEMISTRY OF GLYCOGEN OF RABBIT LEUKOCYTES DURING RADIATION SICKNESS. G. G. Platonov (Kirov Military Medical Academy, Leningrad). Radiobiologiya, 5: 265-7(1965). (In Russian)

The glycogen content in the pseudoeosinophils of x-irradiated rabbits undergoes changes corresponding to changes in their number. The increase in glycogen and the appearance in the pseudoeosinophils of deeply staining glycogen granules the 1st hour after irradiation probably is a nonspecific reaction to the irradiation. The cells richest in glycogen are those whose nuclei have two or three segments. The increase in segmentation parallels the increase in glycogen content of the protoplasm. (tr-auth)

28083 CYTOLOGICAL ANALYSIS OF THE ACTION OF HIGH-ENERGY PROTONS. III. DOSE CURVE AND KINETICS OF CHROMOSOME ABERRATIONS AND MITOTIC INDEX IN MOUSE MARROW AFTER 660-Mev PROTON INFLUENCE AND ^{60}Co γ IRRADIATION. N. L. Shmakova (Inst. of Industrial Hygiene and Occupational Disease, Moscow). Radiobiologiya, 5: 275-8(1965). (In Russian)

Irradiation with 660-Mev protons inhibited mitosis in bone marrow of mice. Chromosome damage appeared as bridges and acentric fragments. The degree of inhibition and the number of cells with chromosome aberrations depended linearly on the absorbed dose. The relative biological effectiveness of protons compared to gamma rays was 0.65 based on the number of cells with chromosome fractures. The data obtained permit estimating of the absorbed dose and may be used for biological dosimetry in known dose ranges. (tr-auth)

28084 CYTOLOGICAL ANALYSIS OF THE ACTION OF HIGH-ENERGY PROTONS. IV. LATENT CHROMOSOME ABERRATIONS INDUCED BY 660-Mev PROTONS AND ^{60}Co γ RAYS. G. F. Palyga (Inst. of Industrial Hygiene and Occupational Disease, Moscow). Radiobiologiya, 5: 279-81(1965). (In Russian)

Protons of 660 Mev energy, like ^{60}Co gamma rays, caused hidden damage to the liver cell chromosomes; this was observed on stimulation of regeneration by hepatectomy. From this the relative biological effectiveness of protons was found to be 0.7. Because the average number of cells with chromosome aberrations is approximately the same for equal doses of x and gamma radiation, the same model may be used for biological evaluations at different postirradiation times. Protons caused a relatively large number of chromosome aberrations in the form of bridges. (tr-auth)

28085 POSSIBILITY OF OBTAINING PLANOCELLULAR METAPLASIA OF SEBACEOUS GLANDS IN IRRADIATED RABBIT SKIN. L. V. Funshtein (Central Scientific-Research Inst. of Roentgen-Radiology, Leningrad). Radiobiologiya, 5: 282-4(1965). (In Russian)

The ears of adult rabbits were irradiated, one ear to 4 kR of gamma (^{60}Co) and the other to 3.6 kR of x rays. Planocellular metaplasia of the sebaceous glands, which developed after injection of Scarlet red into the irradiated skin, was maintained for a long time. Its course was similar for the gamma- and x-irradiated tissue and was independent of whether the dye was injected 2 or 4 weeks after the irradiation. The radiation did not interfere with conversion of the skin appendage to the less differentiated state, stop the conversion of the glands to the phylogenetically older integumentary epithelium, or affect the latent histoblastic ability of the embryonic cells of the glands. (IIC-M.G.)

28086 INFLUENCE OF RETICULO-ENDOTHELIAL SYSTEM BLOCKAGE IN WHITE RATS ON THE CHARACTER OF ACUTE RADIATION SYNDROME INDUCED BY ^{210}Po INJECTION. V. I. Efimov. Radiobiologiya, 5: 315-16(1965). (In Russian)

In male white rats given 0.1 uC/kg of ^{210}Po, the reticulo-endothelial system was blocked with colloidal trypan blue. The blocking only aggravated the course of the radiation sickness despite some precipitation of the isotope in the reticulo-endothelial system. (IIC-M.G.)

28087 X-IRRADIATION INFLUENCE ON FROG RETINA. A. I. Farberov, Z. A. Sokolova, and V. V. Popov (Moscow State Univ.). Radiobiologiya, 5: 319-20(1965). (In Russian)

The heads of adult frogs (Rana temporaria) were irradiated with 10-kR doses, and the retinas were observed for up to 25 days. Damage occurred first (2 hr to 9 days) in the outer layers, which are the most radiosensitive, and then spread to the whole retina. (IIC-M.G.)

28088 ELECTROPHORETIC STUDIES ON SERUM AND TISSUE PROTEINS OF THE LIVER AND TUMORS IN PATIENTS BEARING MALIGNANT TUMORS. PART II. ELECTROPHORETIC STUDIES ON TISSUE PROTEINS OF LIVER AND TUMORS OF ORGANISMS BEARING MALIGNANT TUMORS AND THE EFFECT OF IRRADIATION AND OTHER AGENTS ON THEM. INFLUENCE OF RADIATION AND VARIOUS CHEMICAL AGENTS ON ELECTROPHORETIC PROPERTIES OF LIVER TISSUE PROTEINS OF NORMAL RATS AND YOSHIDA SARCOMA-IMPLANTED RATS LIVER AND THEIR RELATIONS TO THE SERUM PROTEINS. Hirokazu Kaji (Kyoto City Univ.). Sanfujinka No Shinpo, 14: 276-86(Nov. 1962). (In Japanese)

Normal rats and Yoshida tumor-implanted rats were irradiated with x and ^{60}Co γ rays or were given antitumor agents, liver toxins, liver protectants, amino acids, and hormones. Their effects on liver proteins were studied by electrophoresis. Following the same procedure as used for the previous study of serum protein (cf. ibid. 14: 210-18(Sept. 1962)), groups of rats were tumor-implanted, irradiated, given the chemical agents, and their liver tissue proteins were subjected to electrophoretic study. The livers were perfused through the portal veins with 0.05M phosphate buffer to remove blood proteins. The soluble proteins of the liver were extracted for determination of N and electrophoresis. The electrophoretic patterns of normal liver soluble proteins showed six peaks, of which the third was the most prominent. The x-irradiated rats without tumors showed decreases in liver N and soluble protein, and a decrease of the third electrophoretic fraction and increase of the fourth and fifth, when compared to unirradiated controls. TEPA treatment caused a marked decrease of the third fraction and of N and soluble protein, and increases of the fourth and fifth. A liver protectant, thioctic acid, caused no marked variations. A CCl_4-treated group showed decreases of N and soluble protein and of the third peak, and increases of the first, fourth, and fifth fractions. Yoshida sarcoma bearing rats showed decreases of third crest, liver N, and soluble protein, when compared to normal rats. The x-irradiated tumorous rats showed decreases of the third fraction and soluble protein, and an increase of the fifth. The ^{60}Co-irradiated tumorous rats showed a decrease of the third and an increase of the fourth peaks. TEPA treatment of this group showed a marked decrease of third peak, N, and soluble protein, and an increase of the fourth. Mitomycin produced a decrease of third and an increase of fourth peaks in tumorous rats. Moromin-S treatment resulted in increases of N and soluble protein and fourth peak, and a decrease of the fifth.

Thioctic acid in the tumor group showed significant increase of N and soluble protein and the third peak, but a decrease of the fifth. Thus, this liver protectant succeeded in preventing the decrease of liver N and soluble protein caused by TEPA. Testosterone propionate injection produced no marked variations except a decrease of the fifth fraction, and Norandrosterone an increase of N and decrease of the fifth peak. There was a significant positive relation between the liver protein third fraction and serum albumin, and between serum albumin and the liver soluble protein. There were also positive correlations between the liver soluble protein and the serum total protein, between the fourth liver electrophoretic fraction and serum α-globulin, and between the fifth fraction and serum γ-globulin. It is suggested that liver proteins and serum proteins are in dynamic equilibrium. (BBB)

28089 ELECTROPHORETIC STUDIES ON SERUM AND TISSUE PROTEINS OF THE LIVER AND TUMORS IN PATIENTS BEARING MALIGNANT TUMORS. PART II. ELECTROPHORETIC STUDIES ON TISSUE PROTEINS OF LIVER AND TUMORS OF ORGANISMS BEARING MALIGNANT TUMORS AND THE EFFECT OF IRRADIATION AND OTHER AGENTS ON THEM. INFLUENCE OF RADIATION AND VARIOUS CHEMICAL AGENTS ON YOSHIDA SARCOMA TISSUE PROTEIN ELECTROPHORETIC PROPERTIES. Hirokazu Kaji (Kyoto City Univ.). Sanfujinka No Shinpo, 14: 286-91(Nov. 1962). (In Japanese)

Normal and Yoshida sarcoma-implanted rats were irradiated with x rays or ^{60}Co γ rays or given various chemical agents. To remove blood proteins, the whole body of the rats was perfused through the portal vein with phosphate buffer. The abdominal tumors were removed, minced, and rinsed thoroughly with 0.05M phosphate buffer solution. Tumor tissue proteins were extracted for electrophoretic study. Analyses and the electrophoretic pattern of the x-irradiated group showed a decrease of tumor tissue N, soluble protein, and third fraction, and an increase of the fourth and fifth fractions. The ^{60}Co-irradiated group showed the same tendency as seen in the x-irradiated group. A TEPA-treated group showed a marked decrease of tumor weight, N, soluble protein, and an increase of the fourth and fifth peaks. Mitomycin treatment caused a decrease of tumor weight, N, soluble protein, and the third peak, but an increase of the fourth. Moromin-S increased tumor weight, N, and soluble protein, but a decrease of the fifth peak. The liver protectant, thioctic acid, increased the third and decreased the fifth fractions. Thioctic acid in the x-irradiation group showed an increase of third peak, higher than in the x-irradiation group. In the TEPA group, thioctic acid showed a decrease of the fifth peak. Testosterone caused no marked variations. Norandrosterone showed an increase of tumor weight, N, soluble protein, and the third peak but a decrease of the fifth electrophoretic fraction of tumor protein. (BBB)

28090 ELECTROPHORETIC STUDIES ON SERUM AND TISSUE PROTEINS OF THE LIVER AND TUMORS IN PATIENTS BEARING MALIGNANT TUMORS. PART II. ELECTROPHORETIC STUDIES ON TISSUE PROTEINS OF LIVER AND TUMORS OF ORGANISMS BEARING MALIGNANT TUMORS AND THE EFFECT OF IRRADIATION AND OTHER AGENTS ON THEM. INFLUENCE OF RADIATION AND VARIOUS CHEMICAL AGENTS ON THE ELECTROPHORETIC PROPERTIES OF THE YOSHIDA SARCOMA-INDUCED ASCITES FLUID PROTEINS. Hirokazu Kaji (Kyoto City Univ.). Sanfujinka No Shinpo, 14: 291-5(Nov. 1962). (In Japanese)

Ascitic fluid was removed from Yoshida sarcoma-bearing rats and centrifuged at 500 to 800 rpm for five min to separate the sarcoma cells from the blood cells. The blood cells were lysed by adding distilled water to the sediment. The specimen was rinsed with 0.05M phosphate buffer and centrifuged at 3000 rpm for 10 min to isolate the sarcoma cells. Two volumes of the buffer solution was added to the sediment, which was then homogenized. The soluble proteins of the sarcoma were prepared for electrophoresis. The resulting electrophoretic pattern showed six peaks, of which the third was the most prominent. There was no significant difference in the protein pattern between the Yoshida ascites tumor protein and the solid abdominal tumor protein. The group exposed to ^{60}Co-irradiation showed decrease of the third fraction and an increase of the fifth. The TEPA-treated group showed decreases of the second and third and increases of the fourth and fifth fractions. Moromin-S treatment caused a decrease of second and fourth and an increase of the third peak. Thioctic acid caused an increase of the third and a decrease of the fourth peaks. Testosterone decreased the second and increased the third peaks. Norandrosterone increased the fourth and decreased the fifth electrophoretic fractions of ascites tumor proteins. (BBB)

28091 PROGNOSTIC VALUE OF BLOOD SERUM INTERACTION WITH A CULTURE OF PARAMECIUM CAUDATUM IN LETHALLY IRRADIATED RATS. S. Cabadaj and M. Praslicka (Safarika Univ., Kosice, Czechoslovakia). Sb. Prac. Lekar. Fak. Univ. P. J. Safarika Kosiciach, 6: 125-9(1963). (In Czech.)

Attempts were made to develop a prognostic test using a complement-fixation reaction with protozoan antigen and the blood of lethally irradiated animals. The minimal hemolytic dose of complement (MHD) and the number of MHD units of complement fixed by a culture of Paramecia (NMHD) were determined by means of hemolysis of sensitized sheep red blood cells and interaction of serums with a culture of Paramecium caudatum. The rats were irradiated with a dose of 550 R of 180-kv x rays, then examined after four days and followed through the following 30 days. The animals with high NMHD lived longer and in greater numbers than the rats with low NMHD. Those rats with high MHD (low level of complement) also survived longer than the rats with a low MHD. The differences were lower than when prognosis was determined according to the NMHD. The rats with low MHD and NMHD died more frequently than those with high values. (BBB)

28092 IONIZING RADIATIONS AND ODONTO-STOMATOLOGY. G. Carlier and M. Donazzan (Hopital Regional, Lille, France). Semaine Hop. Paris, 39: 2921-4 (Dec. 20, 1963). (In French)

Most injuries resulting from the use of ionizing radiations in odonto-stomatology could be avoided with a clearer understanding of the problem. Dental x rays deliver two to three R to a small area of surface skin. It is essential to avoid unnecessary exposure, because of the cumulative effect of radiation. Many stomatologists and dentists handle their x-ray equipment carelessly, thus exposing themselves unnecessarily. Postradiotherapy erythema is normal and clears up in about 48 hr. Precocious erythematous radiodermatitis causes desquamation and often leaves an ugly pigmented zone. Precocious erythemato-vesicular radiodermatitis results in temporary or permanent epilation. Precocious ulcerous radiodermatitis forms an ulcer in the bare part of the mandible. Delayed scleroatrophic radiodermatitis, after a latency of several weeks to several years, appears as an area of lardaceous consistency intermixed with white regions, pigmented spots, and telangiectases. Excessive irradiation can cause an atrophy of the salivary, submaxillary, and parotid glands. Excessively irradiated teeth go through a process of decalcification which destroys them. Osteoradionecrosis of the mandible, caused by overexposure, destroys the bone. The upper maxillary can be affected also, but not to as great an extent. Secondary irradiation to the mouth region must be avoided. All trauma, whether from mechanical means or infection, must be avoided after irradiation. (BBB)

28093 INDUCTION OF TOLERANCE WITH DISRUPTED ANTIGEN, IMURAN, AND SUBLETHAL IRRADIATION. Martin F. McKneally, William D. Kelly, Jack Resnick, and Carlos Martinez (Univ. of Minnesota, Minneapolis). Surg. Forum, 15: 131-2(1964).

The ability of sublethal irradiation or imuran to reduce the dose of disrupted antigen necessary for the induction of tolerance was studied in C57B1 mice. Full-thickness 1.7-cm grafts of adult male skin were fixed to adult fe-

male recipients. Ninety % of control animals rejected their grafts within three weeks. Test animals were treated by administration of varying doses of donor strain male liver as a single injection (25 mg intravenously, the remainder intraperitoneally) one week prior to grafting. Injections were prepared by mincing fresh liver in Ringer's lactate, disruption by five cycles of alternate freezing and thawing, and filtration through fine mesh stainless steel. Irradiation was delivered at 66 R/min with a 60-cm focal skin distance from a 220-kv x-ray machine. Imuran was administered by intraperitoneal injection of 50 to 100 mg/kg daily for three days prior and three days following antigen injection. Animals in which donor hair growth was definite at ten weeks were considered tolerant. Antigen alone gave a dose-related response curve with a high incidence of takes at 20 g/kg. Imuran alone failed to induce tolerance at any dose level. However, imuran was synergistic with disrupted liver antigen, yielding a high incidence of tolerance at antigen dosage of 2.5 g/kg. Sublethal irradiation gave a linear dose response, with a high incidence of takes at 250 R or more. A synergistic effect of irradiation was demonstrable at 150 R, where 50% tolerance was achieved at 2.5 g/kg of antigen, but 150 R alone failed to produce tolerance. (BBB)

28094 SELECTIVE IMMUNOSUPPRESSION BY LOCAL RADIATION OF RENAL HOMOGRAFTS H. M. Lee, H. M. Kauffman, Richard J. Cleveland, and David M. Hume (Medical Coll. of Virginia, Richmond). Surg. Forum, 15: 158-60(1964).

Sequential local irradiation of renal homografts was used in an attempt to destroy immunocytes, which have migrated to the graft, without producing any general immune system suppression. A total of 61 dog renal homografts was performed. Local irradiation to the transplant was given from a 2000-kvp machine. Three radiation control animals underwent unilateral nephrectomy followed by six 200-R doses (total 1200 R) to the remaining kidney. The homografted animals, which did not receive any other immunosuppressive therapy, were divided into six groups according to the radiation dose and the day of the first dose of radiation. Subsequent doses were given at two- and three-day intervals until the animal received six doses or died. Prolongation of functional survival was obtained in the experimental group which received six doses of 150 R when the first dose was administered on the day of transplantation. Statistically significant prolongation of function was not demonstrated when smaller doses of radiation were used, or if the course of radiation was begun later than the day of operation. The irradiated animals showed reversal of early blood urea N elevations and markedly attenuated or absent round cell infiltration in the graft. Although the mechanism of action of local graft radiation has not yet been fully elucidated, destruction of radiosensitive antibody-forming lymphoid cells which infiltrate the graft may be one mode of action, while interference with antigen-transporting cells may be another. Irradiation of a solitary control kidney in the dose ranges used here produced no impairment of renal function, and irradiation of the transplant with 1500 R just prior to transplantation did not modify transplant rejection. (BBB)

28095 ON THE BEHAVIOR OF THE COAGULATIONS FACTORS PROTHROMBIN, FACTOR V AND FACTOR VII IN RATS FOLLOWING TOTAL-BODY IRRADIATION: DEPENDENCE ON DOSE AND THE EFFECT OF SPLEEN EXCISION. R. Klesper, F. J. Kessler, B. Felderhoff, H. K. Parchwitz, and E. Witteking (Universitat, Bonn). Thromb. Diath. Haemorrhag., 11: 204-9(Apr. 15, 1964). (In German)

Blood clotting factors were studied in adult Wistar rats, some of which were splenectomized. The rats were whole-body irradiated with 1000- or 10,000-R doses of 200-kv x rays. Irradiation was conducted in a single dose at a rate of 250 R/min. Coagulation parameters were studied 24, 48, and 72 hr postirradiation. With 1000-R doses the changes in the factors measured were as follows, on the basis of values of 100% in unirradiated controls: prothrombin 240%, factor V 190%, factor VII 220%. Less marked increases in these factors were noted at 24- and 48-hr intervals postirradiation. In the 10,000-R irradiated rats the 24-hr values were nearly normal and the 48-hr levels resembled the 72-hr levels in the 1000-R series. The 72-hr levels after 10,000-R doses were: prothrombin 310%, factor V 180%, and factor VII 185%. The above values are for irradiated intact rats; splenectomy had no appreciable temporal or quantitative effect on the changes in coagulation factors induced by irradiation. Other parameters measured in 10,000 R irradiated intact rats at 24, 48, and 72 hr were as follows: hematocrit 39, 41, 46 volume %; platelet count 454, 449, $170 \times 10^3/mm^3$. It was concluded that the higher dose reduced the latent period as well as enhanced the increase in the coagulation factors as compared with the lower dose. Prothrombin was the most sensitive parameter to whole-body irradiation of those measured. (BBB)

28096 DOSE-EFFECT CURVES AND SOME MATHEMATICAL MODELS. Bruce J. Biavati (Columbia Univ., New York). Trans. N. Y. Acad. Sci., 27: 551-61(Mar. 1965).

Relations between dose and effect in radiobiological studies are discussed. The target theory of inactivation some of its extensions, and the theory proposed by Rossi based on the concept of local energy density are considered. Theoretical dose-effect curves for single-hit inactivation in 1, 2, 3, and 4 of various numbers of targets and for two-hit inactivation in one of various numbers of targets are given. The effect of local energy density, the energy per unit mass deposited by ionizing particles in a microscopic region of an irradiated material for a given absorbed dose, is discussed. (M.C.G.)

28097 ON THE CONTENT AND INTENSITY OF NUCLEIC ACID METABOLISM IN THE BRAIN OF GUINEA PIGS DURING ROENTGEN IRRADIATION. E. F. Sopin and N. E. Kucherenko (Shevchenko State Univ., Kiev). Ukr. Biokhim. Zh., 37: 258-9(1965). (In Russian)

The nucleic acid content in the guinea pig brain varies in various periods of development of acute radiation sickness. Thus, 30 minutes after irradiation there is a fall in RNA content, which becomes more intense at the end of the first day. During the second to fourth days, the RNA content is gradually restored but decreased during the terminal stage (five days after irradiation). During the first hour after irradiation a tendency toward an increase in DNA content is observed but during the first day the DNA content decreases by 21.4 p.c. with respect to the normal. The DNA content is completely restored during the second and third days and there is a tendency towards an increase. At the end of the fourth day the DNA content falls slightly and by the end of the fifth day the decrease is intensified. The intensity of ^{32}P incorporation in RNA falls sharply during the first day after irradiation, and then rises considerably. By the end of the second day it exceeds the normal, and by the end of third day decreases by half. Phosphorus-32 is incorporated in RNA most slowly during the fourth day, and by the end of the fifth day incorporation sharply increases. Phosphorus-32 incorporation in DNA decreased greatly during the first day after irradiation, and continued decreasing during the second day. During the third day it increased to about normal. However, during the fourth and fifth days ^{32}P incorporation in DNA was greatly inhibited. (auth)

28098 RADIOSENSITIVITY OF BACTERIOPHAGE P22. Hiraku Takebe (Osaka Univ.). Virology, 24: 323-32(Nov. 1964).

Sensitivity of Salmonella phage P22 to x rays and factors modifying this sensitivity were investigated. When P22 phage were x irradiated in nonprotective medium, marked resistance was exhibited by about 10^{-6} of the population. A mutant isolated from the resistant population showed resistance mainly to the indirect effects and the aftereffects of x rays. The resistance seemed to be caused by changes in the protein moiety of the phage

particle responsible for the adsorption of the phage to bacterial cells. A 1:100 dilution of x-irradiated phage suspension into nonirradiated physiological saline prevented further inactivation, suggesting that phage had no remaining potential damages. When phage were irradiated in nonprotective medium and kept in the same medium, aftereffects were observed for at least 96 hr. The processes of adsorption and injection of P22 phage were almost completely resistant to uv light and to direct effects of ionizing radiations. On the other hand, indirect effects of x rays greatly affected adsorption, but to a lesser extent injection. Heat treatment at 80° without irradiation strongly affected both adsorption and injection, presumably because of denaturation of phage protein. When phage were irradiated indirectly by x rays, the frequency of transduction of histidine loci of Salmonella typhimurium by the phage decreased in proportion to the decrease of surviving phage, possibly owing to the failure of adsorption and injection. DNA is the major target of inactivation by uv light and by direct effects of ionizing radiations. In contrast, inactivation of the tail protein of the phage particles appears to be important for indirect effects of ionizing radiation. (BBB)

28099 HOST-CELL REACTIVATION OF LETHAL DAMAGE INDUCED BY ULTRAVIOLET LIGHT AND X-RAYS IN SERRATIA MARCESCENS HY AND ITS PHAGE KAPPA. Ulrich Winkler (Universitat, Frankfurt am Main). Virology, 24: 518-20(Nov. 1964).

Host-cell reactivation (HCR) appears to be controlled by hcr genes located on the bacterial genome. Some hcr mutants have been isolated from Serratia marcescens, demonstrating that there is a genetically controlled mechanism responsible for dark repair of uv-induced damages in DNA. By a new selective technique, it was possible to find 11 hcr mutants in a total of only 150 questionable colonies. Certain properties of these hcr mutants are described. The plaque-forming ability of extra-cellularly uv-irradiated phage kappa plated on Serratia HY wild type decreases exponentially with dose. However, the slope and shape of this survival curve can be changed by using different hcr mutants of Serratia HY as plating indicator. In almost all of the 11 radiation-resistant back mutants isolated from strain hcr 42, the capacity to perform HCR falls below that of the wild type. In extracellularly uv-irradiated kappa at least 93% of the induced lethal lesions can be repaired by HCR as calculated from the phage survival curves on Serratia HY wild type and the most uv-sensitive mutant hcr 42. The survival curve of extracellularly x-irradiated phage kappa, plated on Serratia HY wild type, shows a small shoulder at low doses and then becomes exponential; one lethal hit corresponds to about 117 kr. By using different hcr mutants as plating indicator, the shape of the survival curves of kappa remains unchanged, but the slope varies with the mutant strain, i.e., some of the x-ray-induced lethal lesions in the DNA of kappa are reactivable by HCR. X-ray-induced injuries in the bacteria of Serratia HY, causing loss of the colony-forming ability, are also reactivable by HCR. This indicates that some portion of the energy of primary x-ray quanta absorbed dissipates in excitations similar to those caused by absorption of uv quanta. The HCR of x-ray-induced lethal damages in phage DNA demonstrated here makes it unlikely that thymine dimers are the target for HCR enzyme because no dimers seem to be formed when thymine is treated with x rays under in vitro conditions. (BBB)

28100 THE EFFECTS OF ACTINOMYCIN D AND ULTRAVIOLET IRRADIATION ON THE PRODUCTION OF FOWL PLAGUE VIRUS. R. D. Barry (Cambridge Univ., Eng.). Virology, 24: 563-9(Dec. 1964).

Actinomycin D and uv irradiation both prevent the multiplication of fowl plague (Fp) virus in either chick embryo or allantoic cells at doses that have little effect on the multiplication of Newcastle disease virus (NDV). The effect of each inhibitor on cellular RNA synthesis is compared, using ^{3}H-uridine uptake of the cells. The effectiveness of actinomycin depends on the experimental conditions. In the presence of virus, small doses (0.02-0.1 μg/ml) reversibly inhibit multiplication. If cells are treated before addition of virus, and the drug is removed before addition of virus, doses larger than 0.1 μg/ml are required for inhibition to occur; this form of inhibition cannot be reversed. Within the uv dose range used, the yield of NDV was unaffected. On the other hand, the yield of FP was progressively decreased, although once again the inactivation of capacity was multihit. The same dose range of uv affected the capacity of both cell types to support FP multiplication. Uv affected the ability of susceptible cells to support the growth of influenza viruses at doses which do not affect their ability to support NDV. Consequently, the capacity of cells to support FP is sensitive to irradiation. The effect of uv was irreversible. Both agents prevented the uptake of ^{3}H-uridine at doses similar to those which affect the production of virus. Although it cannot be definitely concluded from such evidence that both inhibitory activities are related and, therefore, that DNA plays an essential role in the production of influenza viruses, the findings are consistent with this conclusion. The alternative conclusion that inhibition of multiplication by these agents is not due to a selective effect on DNA, but due to some indirect effect on the general metabolism of the cell seems less likely. (BBB)

28101 THE RELATIONSHIP OF SERUM LYSOZYME TO LEUKOCYTES AND OTHER CONSTITUTIONAL FACTORS. Stuart C. Finch, Jeredith P. Lamphere, and Seymour Jablon (Atomic Bomb Casualty Commission, Hiroshima). Yale J. Biol. Med., 36: 350-60(Apr. 1964).

In addition to exploring the relation between leukocyte turnover and serum lysozyme, this study was designed to determine whether serum lysozyme levels might reflect alterations in leukocyte or other body tissue turnover in subjects previously exposed to excessive amounts of ionizing radiation. From April to June, 1961, serum lysozyme determinations were performed in 670 regularly-scheduled Japanese subjects participating in the Adult Health Study in Hiroshima, Japan. This was a continuing clinical investigation of possible late effects attributable to ionizing radiation from the atomic bomb. The sample was composed of four age-sex balanced components: Group 1 (within 2000 m of the hypocenter) reported acute radiation symptoms; Group 2 (within 2000 m of the hypocenter) reported no acute radiation symptoms; Group 3 (3000 to 3499 m from the hypocenter); Group 4 (beyond 10,000 m from the hypocenter or not in the city at the time of the bombing). Serum-lysozyme levels were compared to total leukocyte count, absolute granulocyte and monocyte counts, age, sex, month of examination, medical diagnosis, and radiation-exposure status. The levels were found to vary significantly with the absolute peripheral granulocyte count, age, sex, and month of study. A high level of correlation was noted between serum lysozyme and diabetes mellitus, possibly due to a combination of greater than average age in patients with diabetes and underlying inflammatory disease. A possible relation was established between serum lysozyme levels, respiratory diseases and tuberculosis, possibly reflecting active inflammation with excessive destruction of granulocytes and parenchymal tissues in patients with the more acute processes. No correlation between serum lysozyme level and distance from hypocenter or radiation symptoms was found. It had been speculated that a late effect of heavy exposure to ionizing radiation might be diminished granulopoiesis. This should be associated with decreased granulocyte destruction and low serum lysozyme. Neither reduced granulocyte counts nor low serum lysozyme characterized the heavily exposed A-bomb survivors. Previous ABBC investigations also have failed to show a significant relation between previous irradiation and absolute granulocyte levels. If lysozyme is related to the aging process, the question arises as to whether there are differences in the age-lysozyme relation among survivors compared to those not in the city at the time of the bomb. No differences were observed here, but these relations should be tested on a much larger scale. (BBB)

28102 RADIATION SYNDROME AND BIOGENIC AMINES. Fr. Franzen (Universitat, Cologne). Z. Ges.

Inn. Med. Ihre Grenzgebiete, 18: 76-9(Jan. 15, 1963). (In German)

As examples of toxic substances produced by irradiation of animals and humans, urinary excretion of tryptamine, serotonin, bufotenine, histamine, dopamine, noradrenaline, and adrenaline was studied in 45 rats after single whole-body x irradiation. The dosages were 400, 600 and 800 R. Generally, excretion of all of the amines increased in proportion to the amount of irradiation given. The total amounts of amines excreted daily increased gradually to a maximum of 20 to 50 times normal by the seventh to ninth postirradiation day, but the excretion of adrenaline, noradrenaline, and serotonin was greatest. Next in decreasing order of excretion was histamine, bufotenine, dopamine, and tryptamine. However, certain exceptions were noted. More tryptamine was excreted by animals that received 400 R than by those that received 600 or 800 R; more adrenaline was excreted after 600 R than after 800 R. Blood concentrations of serotonin, histamine, and adrenaline were markedly increased in the irradiated animals. The increased concentrations of biogenic amines in blood and urine after whole-body irradiation developed parallel to the appearance of symptoms of radiation syndrome in the animals. (BBB)

28103 RADIATION-INDUCED DELETIONS IN SPERMATIDS AND SPERMATOCYTES OF DROSOPHILA. S. Zimmering and G. Kirshenbaum (Brown Univ., Providence). Z. Vererbungslehre, 95: 301-5(1964).

Previous studies of radioinduced autosomal crossingover in spermatocytes of Drosophila males have suggested that small deletions are induced more readily in spermatocytes than in spermatids. This is based on the observation that from irradiated males of the genotype abd/+++, the frequencies of the r_1 classes, arising as products of exchange or as deletions, are in excess of the corresponding r_2 exchange classes. This excess, presumably representing induced deletions, attains a frequency substantially greater than that for deletions derived from spermatids. Further data on this question were obtained by 1000-r x irradiation of males of the composition X^{Cl}/B^{S} Y y^{+} (collected as prepupae and aged an additional 48 hr) which were then brooded individually for eight days with three virgin ywf females each day. The results suggest that brood days 1 to 3 represent the recovery of cells which were predominantly spermatids at the time of treatment, those from brood days 4 to 6 predominantly spermatocytes, and those from brood days 7 to 8 predominantly spermatogonia. The highest frequency of loss of individual Y markers and XO males, as well as the smallest F_1 population size was found in broods 5 and 6, and especially in brood 6. Further analysis suggests that the vast majority of individual Y-marker losses recovered from diploid cells (spermatocytes, spermatogonia) arose independent of inter-Y arm exchange and Y-autosome translocations. In general, the data confirm the earlier results suggesting that deletions are recovered most readily from spermatocytes than from any other stage in spermatogenesis. They are consistent with the hypothesis that the vast majority of breaks induced in primary spermatocytes restitute, or reunite, producing intrachromosomal changes prior to the time that reunion of breaks induced in non-homologous chromosomes is spatially feasible. (BBB)

28104 GENETIC CONTROL OF DNA BREAKDOWN AND REPAIR IN E. COLI K-12 TREATED WITH MITOMYCIN C OR ULTRAVIOLET LIGHT. Richard P. Boyce and Paul Howard-Flanders (Yale Univ., New Haven). Z. Vererbungslehre, 95: 345-50(1964).

Uv photoproducts in DNA can be rendered harmless in DNA by so-called dark reactivation processes. Escherichia coli is able to repair uv-irradiated DNA without light by a process which involves the excision of photoproducts, including thymine dimers, from the DNA. The excision of photoproducts from DNA is accompanied by DNA breakdown, and is controlled by three widely spaced genetic loci, designated uvrA, uvrB, and uvrC. A mutation at any one of these loci produces a uv-sensitive mutant which is unable to excise photoproducts and shows little uv-induced DNA breakdown in the dark or during photoreactivation. Uv-sensitive mutants of E. coli defective at the uvrA, uvrB, or uvrC locus showed increased sensitivity to the lethal effects of mitomycin C when compared with the uvr^{+} parental strain. In addition, DNA breakdown after treatment of cells with either mitomycin C or with uv light was greater in the parental strain carrying the active uvr^{+} genes than in uvr mutants. Thus, injuries produced by either mitomycin C or by uv light may be repaired by the same molecular mechanism. This mechanism, it is postulated, involves excision of defective bases with the interruption of the phosphodiester backbone, followed by local single strand breakdown and the reconstruction of single strands by the insertion of complementary nucleotides into the DNA. (BBB)

28105 THE EFFECT OF X IRRADIATION ON THE SURVIVAL AND TAKE OF SKIN AUTOGRAFTS. P. Wilflingseder, E. Ruckensteiner, E. Blum, and Chr. Scharfetter (Zentral-Roentgeninstitut, Innsbruck). p.875-71 of "Proceedings of the 3rd International Congress on Plastic Surgery, Washington, D. C., Oct. 1963."

Conflicting previous reports on the effect of radiation on autologous grafts are discussed. These results differ widely because epithelial overgrowth can be easily mistaken for a take in small grafts. Experiments with 128 2 × 2 cm full-thickness grafts in 80 rats confirmed a negative effect of radiation on the viability and take of such grafts. If the grafts were exposed to a single dose of 1000 R in vitro and stored at body temperature for 6 hr, the take was not decreased but hairgrowth was reduced to 50% compared to the controls. When the grafts were stored for 24 hr the take was still 100% but no hairgrowth was seen, whether radiation was applied or not. After a single dose of 2000 R or more, there were no takes whether the grafting was delayed or not. There was no indication in these series that radiation has a positive effect, such as seen with cortisone or cold, on the viability and the take of autografts. These experiments when considered in terms of combined surgical-radiologic treatment in man suggest that fresh autologous autografts may be exposed to 1000 R without risk for their subsequent take, but are damaged when exposed to a single dose of 2000 R. The effects of radiation and the elimination of the capillary circulation due to storage at body temperature appeared related. (BBB)

28106 NEW LIGHT ON RADIATION BIOLOGY FROM ELECTRON SPIN RESONANCE STUDIES. K. G. Zimmer and A. Mueller (Kernforschungszentrum, Karlsruhe, Ger.). p.1-47 of "Current Topics in Radiation Research. Vol. I." Amsterdam, North-Holland Publishing Co., 1965.

Electron spin resonance studies in biology are reviewed. General principles of the use of ESR in radiobiological research are pointed out and exemplified by experimental results. ESR studies on: irradiated complete biological objects; irradiated amino acids, polypeptides, and proteins; irradiated nucleic acids and their constituents; irradiated phage; the mode of action of radioprotective substances; and the mode of action of radiosensitization by halogenated base analogues are discussed. (H.G.D.)

28107 RESPONSE OF BONE MARROW STEM CELLS TO IONIZING RADIATIONS. L. G. Lajtha (Christie Hospital and Holt Radium Inst., Manchester, Eng.). p.139-63 of "Current Topics in Radiation Research. Vol. I." Amsterdam, North-Holland Publishing Co., 1965.

Investigations of the radiosensitivity of bone marrow stem cells as measured by reproductive integrity are discussed. Stem cell recovery patterns, response to repeated or continuous irradiation, and quantitative aspects of radiosensitivity are also discussed. (H.G.D.)

28108 LEUKAEMIA INCIDENCE IN CHILDREN IN RELATION TO RADIATION EXPOSURE IN EARLY LIFE. Alice Stewart and David Hewitt (Oxford Univ.). p.221-53 of "Current Topics in Radiation Research. Vol. I." Amsterdam, North-Holland Publishing Co., 1965.

The concept of an etiological classification of childhood leukemia related to age at onset is stressed. Most of the

significant radiation exposures of early life were received in one of two fairly narrow age-ranges, shortly before and after birth. Hence, the study of narrow age-at-onset groups leads naturally to the study of latent intervals and vice versa. There are two reasons why it has seemed more profitable to concentrate on these aspects of timing rather than on dosage. In the first place, the date of an exposure is often ascertainable even when the dose received can hardly be guessed within an order of magnitude. In the second place, a dose-response curve carries no implications beyond the field of radiobiology, but, as it is suggested, the demonstration of characteristic time-intervals may provide pointers to the origin of leukemia cases which occur independently of radiation. (H.G.D.)

28109 FUNKTSIYA I STRUNKTURA MOZGA ZHIVOTNOGO OBLUCHENNOGO IONIZIRUYUSHCHEI RADIATSIEI V ANTENATAL'NOM PERIODE. (Brain Function and Structure in an Animal Exposed to Ionizing Radiation During Antenatal Period). I. A. Piontkovskii. Moscow, Publishing House "Nauka," 1964. 263p.

Pathogenic effects of ionizing radiation in the prenatal period are considered. Effects of prenatal irradiation on: postnatal ontogenesis, responses of the central system, the behavior of mature animals, and electrical activity and structure of the brain are discussed. Late effects of ionizing radiation on the development of human brain functions are reviewed. (R.V.J.)

28110 RADIATION AND HEALTH. W. V. Mayneord. [London or Oxford], Nuffield Provincial Hospitals Trust, 1964. 140p. 5s.

Radiation hazards are discussed in terms of the overall benefits of the use of radioactive materials outweighing the hazards to human health. (BBB)

Radiation Effects Therapy and Countermeasures

28111 (NP-15040) GLYCIDIC ESTERS AND/OR ORGANIC DISULFIDES, AND RELATED SUBSTANCES, AS SOURCES OF ANTI-RADIATION DRUGS. Interim Research Report No. 22, January 1–March 31, 1965. R. B. Barbee, J. D. Buckman, H. K. Kim, W. B. Lacefield, and L. Field (Vanderbilt Univ., Nashville, Tenn.). Contract DA-49-193-MD-2030. 19p.

Two compounds were submitted for screening as radioprotective compounds. 1,2-Dithiacyclohexane was oxidized to the corresponding thiolsulfonate in 5 to 10% yield using four oxidants. Efforts were continued to establish the structure as a thiolsulfonate and to improve the yield. Oxidation of the cyclic disulfide to the α-disulfone apparently was achieved in 57% yield. Studies of the thiolsulfonate and α-disulfone were continued. Synthesis of unsubstituted trithiopercarbamates was studied further. The t-butyl compound was obtained. For synthesis of the 2-acetamidoethyl compound, use of non-aqueous solvents seems likely to succeed on the basis of preliminary studies. A t-butyl thiolsulfonate reacts with a metallic sulfide to afford a smooth synthesis of t-butyl trisulfide. This approach gave much better results than one based on the reaction of t-butylsulfenyl chloride, an approach similar to a conventional one. o-(α-Picolyldithio)benzoic acid was prepared. To determine whether disproportionation as exemplified by the equation $2ArSS(CH_2)_2NH_3^+ \rightarrow (ArS)_2 + H_3N^+CH_2CH_2S)_2$ is reversible, solutions of the two products were heated. As suspected, none of the unsymmetrical disulfide formed. Thus, the disproportionation is irreversible under the conditions used. Photochemical disproportionation studies of unsymmetrical disulfides were continued. In continuation of studies on mercaptodisulfides, synthesis was achieved of S-2-aminoethyl-2-aminoethyldithiocarbamate dihydrobromide. This compound has interesting protective possibilities since bringing it to pH 7 should result in liberation of 2-mercaptoethylamine (and formation of thioimidazolidone). Additional thiols were screened to determine the practicability of working with the corresponding dithiosulfites, $(RS)_2SO$. Decomposition of phenyl dithiosulfite in a closed system, studied kinetically by infrared absorption, appeared to be strongly autocatalyzed by sulfur dioxide formed. Application of the Kresze-Kort synthesis of thiol-sulfonates (From a sulfinic acid, a thiol, and an alkyl nitrite) to bis-systems was studied further. The yield was improved to 60 to 65%, a marked increase. (C.H.)

28112 (FTD-TT-64-1163) EFFECT OF ADENOSINE TRIPHOSPHATE (ATP) ON THE METABOLISM OF PHOSPHOPROTEINS IN THE LIVER DURING RADIATION SICKNESS. R. P. Vinogradova. Translated from Ukr. Biokhim. Zh., 35: 274-9(1963). 10p. CFSTI.

During the incubation of test pieces with normal liver tissue, when ATP is added in amount of 0.35 m moles per 1 g of tissue are observed increases in the amount and intensity of restoration of phosphoprotein phosphorus. During the incubation of samples from liver tissues of animals, exposed to lethal dosage of x rays, the addition of ATP does not affect the content nor intensity of restoration of phosphoprotein phosphorus. The content of ATP in the liver decreases considerably after the animals are exposed to x rays of lethal capacity. Maximum reduction in amount of ATP is observed on the tenth day of radiation illness. Under the effect of general x radiation the content of phosphorus in phosphoproteins drops on an average to 30 to 35%, and the restoration intensity in comparison with standard rise on an average by 20% in all investigated periods after the exposure. The content of inorganic phosphorus in liver of exposed animals rises on an average by 20 to 35%, and the specific activity remains unchanged. (auth)

28113 THE EFFECT OF SH-INHIBITORS ON THE SENSITIVITY TO RADIATION OF PROTEINS AND AMINO ACIDS. S. Damjanovich, M. Szabolcs, and I. Szatai (Univ. Medical School, Debrecen, Hungary). Acta Physiol. Acad. Sci. Hung., 25: 307-17(1964).

The protective effect of some sulfhydryl-group inhibitors, p-chloromercuribenzoate (PCMB), monoiodoacetate (MIA), reduced glutathione, and $CdCl_2$, were tested on solutions of human serum albumin (HSA) and ovalbumin (OA). When HSA was x irradiated in the presence of PCMB, the spectrophotometrically determined radiation injury of HSA was more severe than that of the protein irradiated without SH-inhibitor. With increase of the radiation dose from 10,000 to 50,000 R, at the same concentrations of protein and SH-inhibitor, the sensitizing effect of the SH-inhibitor increased gradually. The uv absorption curves of HSA irradiated in the presence of less specific SH inhibitors ($CdCl_2$ and MIA), in the 240 to 320 mμ range indicate that the proteins were not so severely damaged as to become denaturated since the absorption curves have the peaks at the same wave length and only the minimums show some bathochromic effect. The irradiated proteins exhibit hyperchromia, indicated by the parallel elevation of the absorption curve. In the range examined, hyperchromia is directly proportional to the x-ray dose. Adding MIA to HSA caused an elevation of the adsorption curve. Irradiated HSA containing MIA had a significantly lower absorption maximum. $CdCl_2$ reduced the absorption of HSA, but after irradiation the elevation of the absorption curve was the same as, or greater than, that of the protein not containing Cd^{2+}. The ultracentrifugal sedimentation of HSA, HSA irradiated with 50,000 R, HSA containing PCMB, as well as of HSA containing PCMB and exposed to 50,000 R was determined. No significant differences were found between the irradiated HSA solutions, the HSA solutions irradiated in the presence of PCMB and their controls, either in the sedimentation coefficients or in the formation of aggregates. (BBB)

28114 TREATMENT OF RADIATION DERMATITIS WITH FLUOCINOLONE ACETONIDE. A. Bjoernberg, L. Hellgren, and S. Olsson (Sahlgrenska Institutet, Gothenburg, Sweden). Acta Radiol., Therapy, Phys., Biol. (N.S.), 3: 129-34(Apr. 1965).

A comparison was made of the topical treatment of radiation reaction with a fluocinolone acetonide ointment and

the ointment base alone in 26 patients receiving radiotherapy for malignant tumors. After three weeks the reaction was significantly less severe in the regions treated with the former; after six weeks the difference was no longer obvious, possibly due to spontaneous healing. (auth)

28115 RADIOPROTECTIVE ACTION OF PYREXAL. K. Fleming (Heiligenberg Inst., Heiligenberg/Baden, Ger.). Arch. Exptl. Pathol. Pharmakol., 250: 248(1965). (In German)

The effect of a Salmonella abortus equi endotoxin (Pyrexal) was studied in the whole-body x-irradiated mouse. Pyrexal was injected intravenously in 0.2- to 100-μg doses per mouse 24 hr before irradiation. When given in this way, the endotoxin was effective in prolonging survival rate of the mice. Since infection is an important factor in postirradiation death, it is suggested that endotoxin, by stimulating the phagocytic activity of the reticuloendothelial system (RES), increases resistance to infection. To support this hypothesis it was found that Pyrexal treatment of mice does, in fact, enhance phagocytic activity of the RES in liver and spleen. However, experiments with graded doses of Pyrexal did not demonstrate a parallel relation between increased phagocytosis and radioprotectivity. It was concluded that these latter parameters are not necessarily interdependent, and that the main mechanism of action of endotoxin in this phenomenon must be sought elsewhere. In this regard, it was found that the endotoxin affected the activity of acid and alkaline phosphatases in liver, released cells from bone marrow, and altered corticoid hormone content of the adrenals. (BBB)

28116 AET AS A RADIOPROTECTIVE AGENT AT THE CELLULAR LEVEL. Roberts Rugh and Karen Fu (Columbia Univ., New York). Biol. Bull., 128: 125-32 (Feb. 1965).

In attempts to better elucidate the mechanism of radioprotection, the most effective agent, AET, was tested at the cellular level, in the unfertilized egg of the sea urchin, Arbacia punctulata. Thus, any irradiation and possible radioprotective action of AET on the haploid cells would be reflected in the early cleavage stages, as well as in early organogenesis. AET was used in a concentration just below the threshold toxicity level in eggs exposed to 50,000 R γ radiation prior to fertilization with normal sperm. Arbacia eggs could be fertilized in 3 mg % AET and would cleave and develop, both in time and manner comparable to the controls in pure sea water. Toxicity was indicated above 5 mg %, particularly after irradiation. Arbacia eggs exposed to 50,000 R of γ rays showed a delay in the initiation of the first cleavage with ultimate cleavage reaching only 11% and abnormalities reaching 18%. Not a single egg so exposed ever reached the pluteus state. The delay in the initiation of the first cleavage was also reduced by a delay in fertilization, and the percentage of ultimate cleavage was improved. The optimum conditions provided were: exposure to 3 mg % AET in sea water for 10 min prior to and 10 min during γ irradiation to 50,000 R, and yet this allowed no improvement in cleavage time, degree of membrane elevation, or development. No eggs thus treated reached either the pluteus or gastrula stages. It is concluded that while AET has proven to be radioprotective for the adult mammal, this protection (survival) may not be effected through individual cells but through tissue or organ regeneration. However, AET may be cell- or species-specific, and the haploid Arbacia cell (cytoplasm and nucleus) is not subject to any protective action from AET. (BBB)

28117 DRUGS ON THE MARKET. E. Tubaro. Boll. Chim. Farm., 103: 162-4(Mar. 1964). (In Italian)

Some new organometallic radioprotective drugs are discussed. (BBB)

28118 SEROTONIN AND LOCAL EFFECT OF X-RAYS. 7th COMMUNICATION. PROTECTIVE EFFECT OF REPEATED INJECTIONS OF SEROTONIN. A. Maggiora (Hopital Cantonal, Geneva). Dermatologica, 130: 12-16 (1965).

When 15 mg of serotonin creatinine sulfate is injected intraperitoneally in guinea pigs 5 min before irradiation, it prevents the temporary radiological epilation otherwise produced by a dose of 800 R. Further experiments have shown that this is still true if the injection, given 5 min previous to irradiation, has been preceded by 15 intraperitoneal injections of 15 mg of serotonin administered every 24 hr. In other experiments, 15 mg of serotonin was injected intraperitoneally four times at intervals of 24 hr. Five minutes following each injection, the guinea pigs were irradiated with 400 R. After this procedure there was no epilation. Since two applications of 400 R each have an epilatory effect, it is evident that protection from an x-ray epilatory effect occurs equally after repeated administrations of serotonin. Therefore, serotonin is effective in spite of a previous treatment by this drug. In additional experiments, 8 injections of 15 mg each of serotonin were given at intervals of 12 hrs. Five min after each injection the animals were irradiated with 200 R. No epilation took place. Since 4 times 200 R doses cause epilation without serotonin protection, it is concluded that several injections of serotonin have acted even though they were preceded by previous ones. Analogous experiments with cysteamine gave no such results, the intraperitoneal doses of 35 and 15 mg proving lethal. On the contrary, serotonin in this dosage was effective. Thus, these experiments performed with various procedures have shown that serotonin is effective as a radioprotectant in the guinea pig although preceded by injections of the same substance. It is emphasized that a 15-mg injection of serotonin is not effective if it is injected more than 6 hr before irradiation. These results are contrary to those of previous studies evaluating other actions of serotonin, wherein its effect diminished after repeated injections. (BBB)

28119 NONPHOTOREACTIVATING REPAIR OF ULTRAVIOLET LIGHT-DAMAGED MICROCOCCUS LYSODEIKTICUS CELLS. Robert L. Elder and Roland F. Beers, Jr. (Johns Hopkins Univ., Baltimore). J. Bacteriol., 89: 1225-30(May 1965).

Micrococcus lysodeikticus cells are highly resistant to ultraviolet radiation. The shape of the dose-survival curve is consistent with the presence of a repair mechanism. The presence of nontoxic doses of dinitrophenol (0.1 mM) or iodoacetate (1 mM) before or after radiation decreases the survival number and the initial lag in the dose-kill curve. The extent of decrease in survival after postradiation treatment with these compounds is dependent upon both time and temperature. Organisms that survive radiation show a prolonged lag phase before multiplying. No photoreactivation of the radiated cells can be demonstrated. Ultraviolet-radiated phage shows a higher inactivation when plated on host cells of M. lysodeikticus treated with dinitrophenol at concentrations which do not affect the infectivity of nonradiated phage. The resistance of these cells to ultraviolet radiation is the result of a very efficient dark-cell repair mechanism that can be blocked by iodoacetate or dinitrophenol. (auth)

28120 THE ROLE OF ANTIBIOTICS IN THE TREATMENT OF ACUTE IRRADIATION SYNDROME. Ferenc Hernadi and Tibor Valyi-Nagy (Debreceni Orvostudomanyi Egyetem, Gyogyszertani Intezet, Debrecen, Hungary). Orv. Hetilap, 104: 913-17(May 19, 1963). (In Hungarian)

A summary is given of research conducted on the role of antibiotics in combatting infections commonly found in radiation sickness. It is pointed out that infection sometimes causes death in experimental animals as well as in patients when the radiation dose alone is not in the lethal range. Conclusions drawn from this review indicate that cellular protection against infection is lowered by irradiation, humoral immune substances are produced in lesser amounts, and endogenous infections are more common. Exogenous infections are also more prevalent and serious in radiation sickness. Recommendations listed include determination of the severity of radiation damage, determination of chances of survival, maintenance of the patient under aseptic conditions, and instituting antibiotic treatment if any sign of infection exists. If one type of antibiotic

fails to control the infection another type should be tried, the required dose administered may be three to four times the normal amount and should be continued until the symptoms of infection are gone. In the event of large numbers of casualties with radiation sickness, when close clinical observation is impossible, those patients who are expected to survive should receive antibiotics immediately. A broad spectrum antibiotic is recommended under these conditions, such as oxytetracycline, in daily doses of 1.5 to 2 g per os. As an antifungal antibiotic to be used in such situations, nystatin is recommended. (BBB)

28121 INFLUENCE OF THYROID HORMONE ON ERYTHROPOIESIS IN IRRADIATED RATS. N. N. Petrishchev (Leningrad Medical Inst.). Radiobiologiya, 5: 211-12(1965). (In Russian)

Rats given large doses of thyroidin after irradiation had a low survival rate. In the survivors of groups given either large or small doses of thyroidin, erythrocyte recovery at 30 days was higher than in the controls. (IIC-M.G.)

28122 INFLUENCE OF ANTIGENS AND OF THE PRODUCTS OF THEIR DEGRADATION ON RADIORESISTANCE OF ANIMALS. A. P. Duplishcheva, K. K. Ivanov, and N. G. Sinilova (N. F. Gamalei Inst. of Epidemiology and Microbiology, Moscow). Radiobiologiya, 5: 243-7(1965). (In Russian)

Complete antigens, lipopolysaccharides, and specific polysaccharides extracted from intestinal bacteria increased resistance of mice and rats to gamma irradiation in sublethal and lethal doses. The protective action of the antigens and lipopolysaccharides is due to the presence in them of specific polysaccharides, since the introduction of as much pure polysaccharide as contained in the antigen or the lipopolysaccharide increased the radiation resistance of the animals to the same degree. (tr-auth)

28123 UNSUCCESSFUL ATTEMPTS TO CONTROL THE REACTION OF THE GRAFT AGAINST THE HOST BY INHIBITORS OF HISTAMINE, 5-HYDROXYTRYPTAMINE, AND PROTEASES. G. Seman, A. Cattan, Rose Tenebaum, Homai da Costa, and Colette Brezin (Hopital Saint-Louis, Paris). Rev. Franc. Etudes Clin. Biol., 9: 627-9(June 1964). (In French)

To study the influence of various chemical agents on the short-term reaction of a graft, F_1(DBA/2 × C_{57}Bl/6) mice were irradiated in toto with 500 Rad. The same day they received 10^7 marrow and $2.5 \cdot 10^7$ lymph cells from C_{57}Bl/6 donors and were divided into five groups. Group A mice served as controls, all of which died before the 30th day with a median survival of 13 days. Group B received 25 mg/kg of mepyramine (an antihistamine) every day. The median survival time was 16 days, but none survived 30 days. Group C received 60 mg/kg/day of methysergide (an antiserotonin). The median survival time was 12 days, with four mice living 30 days. Group D received one million units/kg/day of Kunitz trypsin inhibitor. Median survival time was 14 days, and two lived 30 days. Group E received 15 g/kg/day of ϵ-aminocaproic acid. None of the mice lived 30 days and the median survival time was only eight days. To study the effects of chemicals on the long-term reaction of the graft, F_1(DBA/2 × C_{57}Bl/6) mice were totally irradiated with 950 Rad, and received $2 \cdot 10^7$ C_{57}Bl/6 marrow cells. In the controls, group A, 19 of the 43 mice survived 60 days. Group B, treated with mepyramine, had 14 of 43 surviving 60 days. Group C, treated with methysergide, had 12 survivors. Group D, treated with trypsin inhibitor, had 17, while Group E, treated with ϵ-aminocaproic acid, had 19 mice that survived 60 days. None of the chemical agents decreased the mortality rate due to the reaction of the graft against the host. (BBB)

28124 RADICAL SCAVENGERS AND RADIOPROTECTION. Karl Ford Nakken (Norwegian Radium Hospital, Montebello, Norway). p.49-92 of "Current Topics in Radiation Research. Vol. I." Amsterdam, North-Holland Publishing Co., 1965.

The mechanism of action of radical scavengers in biological systems was discussed in the light of their radical capturing ability in chemical test systems. The data strongly indicate that only radicals formed in the vicinity of the target participate in the indirect effect of ionizing radiation. Probably radical scavengers are unable to prevent the attack of these radicals on target molecules, unless they are concentrated in the vicinity of the target. Although in certain chemical systems trapping of solvated electrons per se, by O_2 or by N_2O, as well as the consequent formation of the radicals O_2^- or N_2OH, have a strong radiosensitizing effect, N_2O and oxygen do not seem to sensitize bacteria by this mechanism. In bacteria the sensitizing effect of oxygen is probably due to the interaction of oxygen with target radicals or with organic radicals formed in the vicinity of the target. Nitric oxide sensitizes bacteria to the same extent as oxygen, in spite of the fact that nitric oxide is an excellent scavenger of the radical species believed to participate in the indirect effect of ionizing radiation. Several excellent OH scavengers are without protective effect in bacteria and in mammals, suggesting that they are unable to interfere with the attack of the OH radicals on target molecules. This may be due to their failure to concentrate in the neighborhood of the target. Furthermore, some aromatic compounds with excellent ability to scavenge OH radicals, are also able to transfer radiation damage to other molecules in test systems. Most data indicate that the effective radioprotective compounds are able to act as scavengers of radicals of low reactivity. Such scavengers may protect by repairing target molecules or by inactivating peroxy radicals formed in the vicinity of the targets. In bacteria and in cellular systems, the cysteamine derivatives seem to protect primarily against the oxygen-dependent part of radiation damage. Several lines of evidence indicate that cells may possess targets other than DNA and that radiosensitive disulphide groups may be target groups. It is suggested that under conditions where protection is obtained by low concentrations of cysteamine derivatives this is mainly due to mixed disulphide formation with such target disulphide groups. (auth)

28125 THE INFLUENCE OF SEROTONIN ON RADIATION EFFECTS IN MAMMALS. Hans-Joachim Melching (Universitat, Freiburg i. B.). p.93-137 of "Current Topics in Radiation Research. Vol. I." Amsterdam, North-Holland Publishing Co., 1965.

The action of serotonin as a radioprotector in mammals is reviewed. Results indicate that there is more than one mode of action. Use of serotonin is limited by three factors: the toxicity; the mode of application; and the time factor. Protection by the drug after whole-body exposure of animals, localized protective effects in organs and tissues, and the effects of serotonin on radioinduced metabolic changes are also considered. (H.G.D.)

Radiation Hazards and Protection

***See also* HEALTH AND SAFETY.**

28126 (ORNL-3809) STOCHASTIC MODELS FOR THE DISTRIBUTION OF RADIOACTIVE MATERIAL IN A CONNECTED SYSTEM OF COMPARTMENTS. S. R. Bernard, V. R. Rao Uppuluri, and L. R. Shenton (Oak Ridge National Lab., Tenn.). June 1965. Contract W-7405-eng-26. 48p. Dep.; $3.00(cy), 1(mn) CFSTI.

A generalized stochastic model is studied, relating to the decay of radioactive material in a compartmental system; this being a continuation of the work for a two compartment model initiated by Bernard and Uppuluri (1964, ORNL-3697 pp. 193-198). This led to the study of simultaneous stochastic difference equations of random vectors, such as $C_m = \Gamma_m C_{m-1}$, m = 1,2 . . . , in which C_m represents a state of the system at the mth stage and Γ_m is a matrix with random elements. From this a recursive multivariate functional equation can be set up between the joint characteristic functions of the components in C_m and

C_{m-1}. Expressions are derived for the means and covariances of the components of the vector C_m. Lastly, a continuous model involving the solution of a system of first order linear differential equations is studied and solutions derived in simple cases. The three compartment model is discussed in full detail and the feasibility of the model is studied. (auth)

28127 (ZfK-Dos-4) EIN FAHRBARES LABOR FUR STRAHLENSCHUTZ-MESSUNGEN. (A Mobile Laboratory for Radiation Protection Measurements). Guenter Scholz, Horst Hoehne, and Erika Tolkendorf (Deutsche Akademie der Wissenschaften zu Berlin (East Germany) and Zentralinstitut fuer Kernphysik, Rossendorf bei Dresden (East Germany)). Feb. 1964. 30p. Dep.(mn).

The necessity of being able to carry out comprehensive radiological measurements outside the Institute led to the development of a measurement truck with its own power supply. The measurement truck was divided into a measurement laboratory and a chemical laboratory. Both laboratories are so equipped that activity determinations can be made of air, water, plants, earth, and food as well as site dose output measurements. (tr-auth)

28128 THE IMPORTANCE OF THE PROFESSIONAL INFORMATION FOR RADIATION PROTECTION IN CONNECTION WITH X RADIATION. H. R. Beck, W. Frik, H. Keim, and H. Braun. Fortschr. Gebiete Roentgenstrahlen Nuklearmed., 102: 453-6(1965). (In German)

Due to the great influence which specialized knowledge of the doctor using x rays exerts on the exposure of the patient to radiation, specialized committal regulations are the most important conditions for adequate protection in the application of x rays. The required knowledge can only be acquired after installment in the course of advanced training directed by a radiologist. The situation may be compared to responsible surgical work, which is not possible either without adequate postgraduate training. The legal position requires specialized regulations, which do however not interfere with the freedom of medical action and are feasible from the point of organization. (auth)

28129 SURVEY OF IONIZING RADIATION SOURCES. William T. Willis (State of Alabama Dept. of Health, Montgomery). J. Med. Assoc. State Alabama, 33: 365-7(May 1964).

A program was initiated in Alabama in 1958 for the reduction of exposure to radiation from dental x-ray units to the public and dental personnel. This reduction was accomplished by installing adequate filters and collimators in x-ray units in dental offices. Filters and collimators were sent to 611 Alabama dentists for this purpose. The second phase of this program was a four-hour course in dental radiological health to provide dentists with additional training in the basic principles of reducing exposure. In March 1961, an evaluation was begun of conditions within the dental offices in Jefferson County, including the installation of adequate filters and collimators in all dental x-ray units within the County. Organized in January, 1963, the Division of Radiological Health of the State Department of Public Health directed its first year's activities toward organizing a radiological health program, with a physical survey of all dental x-ray units within the state. Two-man teams surveyed dental units in the state, first measuring the beam size of the unit, before correction, and then total filtration of the machine. The survey team then asked the dentist to allow them to install the necessary filtration and collimation to bring the unit into compliance with recommendations of the American Academy of Oral Roentgenology. The roentgen output of the primary beam was determined before and after installation of additional filtration. Other information obtained included the estimated number of films exposed each week, average exposure time per film, type of film used, type of developer, and time of development. Of 677 dental x-ray units checked, 242 units needed filtration, 16 needed collimation, and 113 needed both filtration and collimation; 306 units needed no corrections to comply with the standards recommended by the American Academy of Oral Roentgenology. Thus 54.8% of the units surveyed needed some correction in order to bring them into compliance with the recommendations. An estimated 2,340,000 dental x-ray exposures are made each year within the state. (BBB)

Radiotherapy and Radiodiagnosis

Refer also to abstract 28672.

28130 (TID-21870) THE BIOLOGIC EFFECTS OF RADIATION ON THYROID TISSUE. Final Report. Oliver Cope (Massachusetts General Hospital, Boston). May 1965. Contract AT(30-1)-667. 12p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Progress is reported in a study of the possible carcinogenic effects of ^{131}I therapy used for the treatment of hyperthyroidism. Data on patients treated with ^{131}I over the past 20 yr indicate that there may rarely be some influence of the irradiation toward tumorous degeneration of the thyroid gland, particularly in young people. Results are reported from histological studies of biopsy material in patients with hypothyroidism given ^{131}I treatment before and after thyroxine therapy and from studies of γ dosimetry in tissue-equivalent materials. Data are included from histologic studies of the thyroid glands of rats after sublethal doses of ^{131}I. Cellular hypertrophy and bizarre changes in the nuclei were the most pronounced findings. (C.H.)

28131 (UCRL-12492) SPECIAL PROBLEMS OF THYROID DOSIMETRY: CONSIDERATIONS OF I^{131} DOSE AS A FUNCTION OF GROSS SIZE AND INHOMOGENEOUS DISTRIBUTION. Lynn R. Anspaugh (Lawrence Radiation Lab., Univ. of California, Livermore). Mar. 25, 1965. Contract W-7405-eng-48. 22p. Dep.; $1.00(cy), 1(mn) CFSTI.

Problems concerned with an accurate calculation of ^{131}I dose to the thyroid are considered. Detailed calculations are presented which show that there is an error of only 3 to 6% involved if dose equations which treat the thyroid as an infinite medium are used. This is true even for an infant's thyroid weighing only 1.71 g. The effects of apparent nonuniform distribution of ^{131}I are also considered. A model system wherein all the ^{131}I is confined to colloid spheres occupying 50% of the thyroid volume is found to deliver a uniform dose throughout the thyroid. The possibility that hot spots involving several follicles might occur is considered in light of reported literature studies of human and animal thyroids. The conclusion drawn from these considerations is that such hot spots will not occur in normal thyroid tissue, but very likely might occur in diseased thyroid tissue. (auth)

28132 (NP-tr-1227) INTENSIFICATION OF THE RADIOLOGICAL IMAGE. G. Gregorio. Translated by Q. S. Whitston (U.K.A.E.A., Atomic Energy Research Establishment, Harwell, Eng.), from Radiol. Med., 49: 640-9(1963). 21p. Dep.(mn); $2.60(fs), $0.83(mf) JCL.

The theoretical bases that permit realization of a new intensifying system are discussed. This system has made it possible to obtain cineradiographic and photofluorographic images of satisfactory quality, even with very low loads. These results represent the best confirmation of the opinions relative to the fluctuation theory in radiodiagnosis. (auth)

28133 DIAGNOSTIC VALUE OF ^{131}I IN THYROID DISORDERS: A STUDY OF 649 PATIENTS. M. O. Dyrbye, E. Peitersen, and Th. Friis (Frederiksberg Hospital, Copenhagen). Acta Med. Scand., 176: 91-101(July 1964).

Results are reported in a large number of cases on the ^{131}I uptake measurements carried out 4 and 24 hr after oral administration of ^{131}I doses of 10 to 20 μC. Protein-bound iodine ($PB^{131}I$) was determined 24 hr after the administration of ^{131}I. The following normal ranges were found: 4-hr uptake, 32% ± 14.7% (range about 15-45%); 24-hr uptake, 51% ± 20.2% (about 30-70%); and $PB^{131}I$ below 0.3% per 1 serum. While about 32% of the control patients were outside the normal range for the uptakes, only 3% had $PB^{131}I$ values exceeding 0.3% per 1 serum.

Among 92 hyperthyroid patients, 12% had 4-hr uptakes lower than 45%, and 35% had 24-hr uptakes lower than 70%. As regards $PB^{131}I$, 8% were below 0.3% per 1 serum. Among the 26 myxedematous patients, 19% had a 4-hr uptake exceeding 15%, while none had uptakes exceeding 30% 24 hr after administration of ^{131}I. On the other hand, the $PB^{131}I$ test was worthless in this group. In other words, in diagnosing hyperthyroidism the 4-hr uptake and the $PB^{131}I$ are of importance and in diagnosing hypothyroidism only the 24-hr uptake. Among the other groups of patients it was found that the uptake in the presence of nontoxic goiter was like that in the control group and that the $PB^{131}I$ was elevated in about one-quarter of the thyroidectomized patients. The normal limits in this series are higher than in American material; previous Danish publications have also reported higher normal uptake. (BBB)

28134 ATTENUATION OF GAMMA RADIATION FROM ^{60}Co, ^{137}Cs, ^{192}Ir, AND ^{226}Ra IN VARIOUS MATERIALS USED IN RADIOTHERAPY. R. Thoraeus (Karolinska Institutet, Stockholm). Acta Radiol., Therapy, Phys., Biol. (N.S.), 3; 81-6(Apr. 1965).

The attenuation of gamma radiation from ^{137}Cs, ^{60}Co, ^{226}Ra, and ^{192}Ir was studied experimentally, using narrow-beam geometry, in 12 different materials of interest in radiotherapy and in clinical radiophysics work. The results are given for the first and second half-value layers of water and tissue-equivalent materials, metals with properties that make them suitable for half-value layer measurements, and heavy metals suitable for use in wedges, filters, and radiation shields. (C.H.)

28135 TUMOUR DOSE CONCEPT. L. Sundbom and P. E. Asard (Karolinski Institutet, Stockholm). Acta Radiol., Therapy, Phys., Biol. (N.S.), 3: 135-42(Apr. (1965).

It would be an advantage if the term tumor dose could be uniformly defined in order that comparisons of different patients and patient groups as regards dose levels and radiation techniques could be facilitated. It is suggested that the term average dose may be the best one to use. (auth)

28136 FURTHER DEVELOPMENT OF THE HEYMAN RADIUM PACKING METHOD. Olle Kjellgren and Lars Jonsson (Univ. of Umea, Sweden). Acta Radiol., Therapy, Phys., Biol. (N.S.), 3: 143-51(Apr. 1965).

A further development of the Heyman radium packing method used for the treatment of cancer of the uterus, based on a high primary filtration of the radium tube, is described. The radium tube is permanently closed in a container of stainless steel to avoid the loading procedure. A rapid means of attaching and removing additional filters, special handling tools and a radium cart, are special features of the technique. (auth)

28137 IODINE 125 AS A RADIATION SOURCE WITH SPECIAL EMPHASIS ON ITS APPLICATIONS IN MEDICAL RADIOLOGY. II. AgI AND CuI AS POINT ROENTGEN SOURCES. P. Beronius, S. Forberg, C.-O. Henrikson, and R. Soeremark (Royal Inst. of Tech., Stockholm; Royal School of Dentistry, Stockholm; and Harvard Dental School of Medicine, Boston). Acta Radiol., Therapy, Phys., Biol. (N.S.), 3: 152-60(Apr. 1965).

The preparation of point $Ag^{125}I$ roentgen sources by the electrolytic deposition of ^{125}I on silver micro-electrodes in the development of light portable roentgen units is described. (auth)

28138 PROBLEMS OF RADIATION BURDEN WITH X-RAY TELEVISION. Helmut Fendel (Universitat, Tubingen, Ger.). Aerztl. Forsch., 18: 486-91(Sept. 10, 1964). (In German)

When the radiation burden imposed by fluoroscopy was compared between use of a fluorescent screen alone and various image intensifier-television systems, wide differences were observed. However, the systems used all reduced the radiation burden considerably below that imposed by the fluorescent screen alone. In lung studies the reduction amounted to from 31 to 62%, but in stomach studies the dose was essentially the same in all the measurements. In other studies of the upper gastrointestinal tract the viewing time and the number of photographs obtained were increased with an image intensifier-television screen system, but the surface dose, measured in terms of R/cm^2, was increased. In studies of the colon the surface dose was reduced by 30%, and the gonadal dose by 47% when the image intensifier-television system was used. (BBB)

28139 X-RAY PELVIMETRY–A CRITICAL APPRAISAL. Walter J. Hannah (Women's Coll. Hospital, Toronto). Am. J. Obstet. Gynecol., 91: 333-40(Feb. 1, 1965).

In view of the radiation exposure of the fetus during x-ray pelvimetry, and its possible deleterious effects, an attempt was made to assess the value of this procedure by analysis of 300 cases. It is suggested that most obstetricians have felt that whatever hazards to mother and fetus resulted from its use were outweighed by its assistance in the conduct of a difficult labor. Now, however, in the light of vastly improved understanding of the phenomenon of uterine dysfunction, increasing recognition that most fetopelvic disproportion is relative, and often easily overcome by a good labor, and the gradual acceptance of the safety of careful and expert oxytocin administration in the presence of hypotonic uterine inertia, x-ray pelvimetry has outlived its usefulness. The technique used is a standing lateral film of the pelvis. In addition to the morphologic features of the pelvis, the anteroposterior dia of the midpelvis is measured. Classification of the films was made according to their value in the conduct of the case. A film was considered unnecessary, if there was sufficient clinical information available to allow a sensible, logical decision to be made regarding the future management of the case without an x ray. Using this criterion, 258 cases, or 86% were considered to be unnecessary in the proper conduct of the case. Sixty cesarean sections were performed for failure of labor to progress when the x ray demonstrated a perfectly adequate pelvis. In 12 cases a film was considered to be helpful but not really necessary. In only 15 cases was the decision to forbid or permit a trial of labor made mainly on the radiologic findings. These 15 constituted only 5% of the entire series. It is emphasized that radiation, in any form, cannot be considered innocuous. Thus the Genetics Committee of the National Academy of Sciences has set 10 R as a permissible accumulated dose of medical radiation in the first 30 yr of life; the best estimate of the mother's gonadal dose from pelvimetry is from 2 to 4R, while that of the fetus varies from 0.5 to 7 R. It is evident that diagnostic pelvimetry is potentially, if not actually, hazardous. It is concluded that radiologic pelvimetry is rarely needed and that the required information can be obtained by other means. (BBB)

28140 POSTIRRADIATION SIALADENITIS. A STUDY OF THE CLINICAL FEATURES, HISTOPATHOLOGIC CHANGES AND SERUM ENZYME VARIATIONS FOLLOWING IRRADIATION OF HUMAN SALIVARY GLANDS. Haskins K. Kishima, William R. Kirkham, and J. Robert Andrews (National Cancer Inst., Bethesda, Md.). Am. J. Roentgenol., Radium Therapy Nucl. Med., 94: 271-91(June 1965).

The acute clinical picture that results from irradiation of the salivary glands consists of transient swelling of these glands, generally unaccompanied by fever or leukocytosis. Evidence is presented that implicates the salivary glands as the tissues of origin for the postirradiation hyperamylasemia. The acute histopathology of the irradiated human salivary glands is presented and the clinicopathologic correlation is discussed. The possible usefulness of hyperamylasemia as a biologic indicator of radiation exposure is suggested. (auth)

28141 THE USE OF ISOTOPES IN GYNECOLOGY. P. M. Van Vaerenbergh and M. Thiery (Rijksuniversiteit, Ghent). Ann. Belg. Med. Mil., 19: 1301-2(Dec. 1, 1963). (In Dutch)

Applications of radioisotopes for diagnostic and thera-

peutic methods are discussed. Technics of renography and hepatography are presented, and the use of Co and Au isotopes in the treatment of malignant tumors is considered. (BBB)

28142 HEAVY PARTICLES AND THE BRAGG PEAK IN THERAPY. John H. Lawrence, Cornelius A. Tobias, John A. Linfoot, James L. Born, Elward Manougian, and John Lyman (Univ. of California, Berkeley). Ann. Internal Med., 62: 400-7(Feb. 1965).

The biological properties of heavy particles are discussed as well as their use during the past 10 years to treat over 325 patients to suppress the function of or to ablate the hypophysis. Such treatment is used in such diseases as metastatic breast carcinoma, diabetic retinopathy, acromegaly, chromophobe adenoma, Cushing's disease, and malignant exophthalmos, and to treat directly neoplasms and other conditions of soft tissue and brain. The suppression of pituitary function in breast cancer patients was evidenced by a fall in target organ hormone outputs after irradiation. The results showed remissions in about 30% of the cases, varying from 6 months to over 6 yr. These results approximate those after surgical hypophysectomy; however, with heavy particle therapy the patient is ambulatory, the method is painless, and the cranium is not entered surgically or by needle. During the past 6 yr, 38 acromegalic patients have been treated with heavy particle beams, and follow-up studies have demonstrated beneficial changes both subjectively and objectively. Partial or complete hypophysectomy has been achieved with the α-particle beam in an attempt to slow down the progressive severe diabetic retinopathy in over 100 patients. There was a fall in insulin requirements and target organ hormone outputs after suppression of pituitary function. The Bragg peak has been used to treat soft tissue tumors and brain tumors directly. The Bragg peak, greater RBE of dense ionization, lack of scatter, decreased oxygen effect offer improved results. A chief difficulty in the treatment of neoplasms in humans is the accurate localization of the tumors. Unless the radiation can be distributed accurately throughout the tumor, improved results cannot be expected even though greater dosages can be given while sparing the skin and intervening tissues. Heavy particles generated in tissue by pi mesons produce dense ionization, and biological and medical implications of these particles are now being explored. (BBB)

28143 RADIOTHERAPY OF MALIGNANT TUMORS IN CHILDREN: A STUDY OF 148 CASES. Antero Voutilainen and Ritva Rekola (Univ. Central Hospital, Helsinki). Ann. Paediat. Fenniae, 10: 187-202(1964).

Radiosensitivity and dose data are presented for various malignant tumors occurring in childhood, treated with 180-kv x rays. Late reactions from brain irradiation are described. The largest group treated was nephroblastomas or Wilms' tumors (29); of these, 11 patients (38%) lived for at least 5 yr. Pre- and post-operative irradiation was given in 16 cases, of which 8 survived. Radiotherapy after surgery did not seem to have given as good a result. The treatment of other renal and adrenal tumors was unsuccessful. Five (24%) of the patients recovered; all had been treated with irradiation postoperatively. All the ocular tumors had been irradiated postoperatively, and 11 out of the 13 patients recovered and were symptom-free (85%). Five (22%) of the 18 patients with osteosarcomas survived for over 5 yr; two had been treated with radiotherapy alone while another two had had preoperative irradiation and surgery. With renal neoplasms, after irradiation with a tumor dose of 1500 to 2000 R from two or three fields, the circumference of the abdomen diminished. Larger doses, of 2500 to 3000 R, are recommended in the literature, but experience showed that operability was maintained with the doses applied. During irradiation the surrounding healthy tissue was protected by lead. Postoperative radiotherapy was generally begun after days 10 to 14, sometimes even after 5 days, the incision being protected by lead. The full tumor dose in the 5-yr survival group was in two cases 2500 R, in 13 cases about 4000 R, and in four cases 5000 to 5500 R. The doses were governed by the size of the tumor, the patient's general condition, and the tolerance shown by the blood picture. Leucocytes, generally, should not fall below 3000/mm^3. For postoperative radiotherapy alone the preferred tumor dose was about 4000 R. Brain tumors were usually radically removed, and post-operative treatment thereafter consisted of a 5000 to 6000 R tumor dose. The size of the total dose of irradiation was discussed in consideration of the cerebral tissue involved. Some radiologists recommend that the dose should not exceed 4000 R since irradiation may damage the sensitive brain cells. In the present series in cases where irradiation was kept below 4000 R because of poor general condition, relapses occurred earlier than with doses exceeding 5000 R. Patients exhibited few after-effects. One 11-yr-old child with spongioblastoma given 6075 R for the first few years had occasional headaches, depressions, and vomiting but the symptoms diminished and four yr after the irradiation, they ceased. Another patient, with a temporo-occipital ependymoma, given 6336 R for two yr suffered from headaches and myopia. Some patients had nocturnal enuresis, and temporary loss of memory. The first principle of radiotherapy in pediatrics is to try to avoid this method if there is an alternative therapeutic method of equal efficiency. The second principle is that normal tissue must be protected as far as possible and every effort made to reduce the dose in normal tissue to a minimum. In the treatment of hemangioma, for instance, it is best to employ β-irradiation applicators of ^{32}P so that healthy tissue will receive little irradiation. The current trend is to avoid irradiation treatment. Anoxia reduces sensitivity to irradiation, and by correcting it, it is possible to get a better tumor reaction to irradiation. Infection also increases resistance to irradiation and reduces the toleration of normal tissue, so that antibiotics may be useful. When radiotherapy is given, it should be considered that sensitivity to irradiation is proportional to the tumor's rate of growth, i.e. the mitotic frequency, and inversely proportional to the degree of differentiation in tumor tissue. For instance, lymphosarcoma grows fast and is rapidly destroyed by irradiation but it also metastasizes readily. Neuroblastomas react poorly to irradiation. (BBB)

28144 RESULTS OF ROENTGEN THERAPY OF CARCINOMA OF THE NOSE. H. L. Stoll, Jr., Halina Milgrom, and H. L. Traenkle (Roswell Park Memorial Inst., Buffalo, N. Y.). Arch. Dermatol., 90: 577-80 (Dec. 1964).

Dose data and treatment schedules in relation to cure rate are provided with reference to 338 skin cancers, of which 276 were basal cell carcinoma and 62 histologically proven squamous cell carcinoma. Most lesions were treated with single-field roentgen therapy, 100-kv, and target-skin distance 15 or 18 cm. Other lesions were treated before 1950 with the large-fraction technique used at that time: 1000 R given four times over a period of eight to ten days resulting in a total dose of 4000 R. Because of the occurrence of late radiation necrosis in a disturbing proportion of cases receiving the 1000 R increments, after 1950 all lesions were treated with daily fractions considerably smaller than 1000 R. Thus 204 basal cell carcinomas and 42 squamous cell carcinomas were treated with smaller increments of 500 R given nine times within 11 days, 400 R given 13 times within 17 to 19 days, or 300 R given 18 times within 24 to 26 days. Contact roentgen therapy (45-kv) was used to treat 25 basal cell carcinomas smaller than 1.5 cm in dia, the dose consisting of 4000 R given on two occasions one week apart, resulting in a total dose of 8000 R. The cumulative probability of cure was 89.5% for 276 basal cell carcinomas of the nose and 94.5% for 62 squamous cell carcinomas of the nose. Age of patient, sex, tumor size and tumor site did not influence the failure rates. The differences in failure rates among the four radiation schedules were significant for squamous cell carcinoma but not for basal call carcinoma. The occurrence of failures both in the center and at the edge of the radiation field

suggests that failures in this study resulted from difficulty in estimation of tumor size and depth. Although tumor response to radiation is determined by multiple factors, treatment failures at the periphery of the field are considered to be the result of a field of insufficient size, while those in the center of the field are considered to be the result of insufficient central tumor depth dose. (BBB)

28145 GRENZ RAYS AND LICHEN PLANUS: REPORT OF A CASE OF ISOMORPHIC PHENOMENON FOLLOWING GRENZ RAY THERAPY. Roger H. Brodkin and Jacob Bleiberg (Newark Beth Israel Hospital, N. J.). Arch. Dermatol., 91: 149-50(Jan. 1965).

A case report is described in detail to indicate side-effects of soft x-ray therapy in a benign disease. A case is reported of acute eruptive lichen planus in which grenz rays were used on two areas as a part of the treatment. It was observed that in the two areas given 400 R of grenz rays over a four-week period, an intense isomorphic phenomenon occurred with confluence of the eruption. The patient was first given a suberythema dose of generalized uv light. He was then submitted to grenz (12-kv) ray treatment consisting of 100 R to the arms and dorsal surfaces of the hands. On the third, fourth, fifth, and sixth visits he was given grenz rays, 100 R to two areas of the back. One week after the fourth grenz ray treatment it was noted that the areas treated presented a confluent eruption of lichen planus, while on the rest of the body no new lesions had appeared and, in fact, the eruption was beginning to improve. The grenz ray therapy was then stopped, and he was continued on systemic and topical treatment without grenz ray therapy. Over the next four months the areas treated with grenz rays healed progressively, becoming hyperpigmented, but by the time the generalized eruption had faded, the two areas treated with grenz rays had almost caught up in their resolution to the other lesions. It is concluded that although grenz rays are frequently suggested for the treatment of lichen planus, it should be remembered that this type of radiation is capable of producing an isomorphic phenomenon in this disease, particularly the acute generalized type. (BBB)

28146 FURTHER STUDIES OF THE SHORTENING OF THE WHEAL RESORPTION TIME IN THE SKIN. Carl Georg Schirren and Liselotte Gruber (Universitat, Munich). Arch. Klin. Exptl. Dermatol., 217: 513-17 (Nov. 6, 1963). (In German)

Wheal resorption time can be reduced by uv ray, x ray, or rubriments. Ultraviolet irradiation exposure for 3 min decreases normal wheal resorption time from 58 min down to 23 min. If this is followed by 400 R of x irradiation the wheal resorption time drops to 18 min. If the x irradiation is given first the original value of 58 min decreases to 28 min, and to 13 min if uv irradiation is given 24 hr later. After a rubriment is applied to skin the wheal resorption time decreases from 58 min to 26 min within 10 or 15 min. If 400 R of x irradiation is then given, the wheal resorption time falls to 20 min. When the order of these procedures is reversed, the wheal resorption time decreases from 58 min to 28 and 18 min, respectively. If 2000 R of x irradiation is given initially and is followed by 15-sec exposure to uv, the wheal resorption time decreases successively from 58 to 6 and 1 min, respectively. After 10-sec exposure to uv, followed by 400 R and then 2000 R of x irradiation, the wheal resorption time falls from 58 to 4 and 1 min, respectively. (BBB)

28147 IMPROVEMENTS MADE IN SCINTIGRAPHY: VARIABLE CONTRAST AND PANCREATIC IMAGE, STENOPAIC CAMERA. A. Desgrez and C. Kellershohn (Commissariat a l'Energie Atomique, Orsay, France). Arch. Maladies App. Digest. Maladies Nutr. 52: 1280-5 (Dec. 1963). (In French)

The advantages and disadvantages of various procedures used to obtain variable contrast in scintigraphy of pancreas and liver are discussed. These methods include background erase, system erase, or nonlinear amplification. Factors like statistical fluctuation limit the resolution obtainable by any method. Applications of oscillography and contrast amplification to improvement of resolution of radioisotope deposited in pancreas and liver are briefly discussed. The photographic techniques and general principles of construction of a γ scintillation camera, where the objective consists of a small opening called a stenope, are described. In effect, the device acts somewhat in accord with the principle of the pinhole camera, where the photographic plate is replaced by a scintillation crystal backed up by several photomultipliers, with their related electronic circuitry. The information collected by this arrangement is presented as an oscilloscopic display. The image produced is obtained more rapidly than ordinary scintigraphic methods. (BBB)

28148 BOWENS'S DISEASE OF THE NASAL MUCOSA. Hansjuergen Boy (Universitat Wuerzburg, Ger.). Arch. Ohren., Nasen., Kehlkopfheilk., 181: 291-6(Nov. 5, 1963). (In German)

Histologic reactions in the nasal mucosa following ^{60}Co irradiation are briefly described. (BBB)

28149 PREOPERATIVE IRRADIATION IN HEAD AND NECK CANCER SURGERY. W. E. Powers and J. H. Ogura (Washington Univ., St. Louis). Arch. Otolaryngol., 81: 153-60(Jan. 1965).

The effect of preoperative radiation therapy on the surgical cure rate of solid subcutaneous 6C3HED tumor grown in the flank of C3H mice was studied. The cellular sensitivity and survival of this tumor were determined in vivo; they yield a biphasic survival curve which appears to arise from heterogeneity of the cells with respect to the degree of oxygenation. A dose of 500 rad kills (inactivates reproductively) about 99% of the cells of this tumor but causes no cure of the tumor in the clinical sense. Four groups of mice bearing transplanted tumor in the soft tissue of the flank were studied. Mice in groups one and four received no treatment. The mice in groups two and three received a single 500-rad dose of 220-kv x rays to the tumor site and surrounding skin. The tumors in the mice in groups three and four were excised immediately after irradiation. Survival rates in groups one to four were 0, 0, 85, and 53%. Thus, the radiation administered was of itself insufficient to cure any tumor. The surgical cure of this tumor using the best surgical technique available was only 53%. This indicates a high recurrence rate due either to the local remnant tumor or to dissemination of tumor at surgery. The difference in cure rates between the animals given preoperative radiation (85%) and those with surgery alone (53%) was highly significant. No delay in wound healing was observed in the animals receiving preoperative radiation therapy as compared with those treated by surgery alone. These results suggest that relatively small doses of radiation administered preoperatively may be useful in increasing the cure rate when surgical extirpation of the tumor is expected to be followed by a significant incidence of local recurrences or metastasis associated with the surgical procedure. The clinical material consisted of 30 patients with moderately advanced carcinoma of the head and neck treated with preoperative ^{60}Co radiation therapy and radical surgical removal of the primary lesion with radical neck dissection. Five patients have had recurrence of the tumor, either locally or in another site, and one patient has developed a second primary tumor. Three of the five patients with recurrence had this recurrence in the opposite side of the neck from the primary tumor. Evaluation of this treatment was not possible in this preliminary report, but there probably was some decreased recurrence rate in this group of patients. The doses administered did demonstrate effectiveness in modifying the histological characteristic of these tumors. The doses administered were well below the doses associated with radiation cure of any of these patients. (BBB)

28150 TRANSPLANTABLE LUNG CANCER IN RATS: EFFECT OF TREATMENT. Ali Farpour, Domenico Agostino, and Eugene E. Cliffton (Sloan-Kettering Inst.

for Cancer Research, New York). Arch. Surg., 89: 942-8 (Dec. 1964).

The effects of ^{90}Y microspheres and/or Nitromin (nitrogen mustard) treatment of rats with lung tumors (transplanted Walker 256 carcinosarcomas) was studied. Yttrium-90 tagged microspheres were injected intravenously four days after tumor inoculation in doses of 1.7 mC. Nitromin, 0.4 mg/kg, was given four days after the implant and then two times weekly for three consecutive weeks. The results demonstrated that there was no significant improvement in survival or even in development of tumors in the animals treated with Nitromin in a single injection or with intermittent treatment for three weeks. There was no significant improvement in survival or tumor growth in the animals treated with Nitromin and heparin. One group that showed a significant change in survival and tumor growth was treated with Nitromin and fibrinolysin. The group treated with ^{90}Y showed the best results as far as inhibition of tumor growth alone was concerned, but the survival was not significantly changed. Many of the deaths were probably due to effects of the radiation itself. (TCO)

28151 PHARMACORADIOLOGY WITH MODERN X-RAY INVESTIGATION METHODS. A. Gebauer (Universitat, Frankfurt am Main). Arzneimittel-Forsch., 15: 20-4 (Jan. 1965). (In German)

The use of enteroactive drugs in fluoroscopy, conducted with television equipment, as a means of reducing patient x-ray exposure, is discussed. (BBB)

28152 LOW-LEVEL GAMMA COUNTERS AND THEIR USES IN BIOLOGY AND MEDICINE. Stelios Regas (Metrix Inc., Deerfield, Ill.). Biomed. Sci. Instr., 1: 239-48(1963).

A summary is made and brief description given of very low level γ counters and of their uses in biology and medicine. Mathematical principles which make low level counters possible, brief descriptions of the different kinds of whole-body counters or low level γ counters, their advantages and disadvantages, and their applications are considered. Several counters in use in various labs are illustrated. Counters are divided into two categories depending on the kind of detector that is used. One category consists of those using NaI crystals, and the other those using organic detectors, subdivided into liquid and plastic detectors. One difference between NaI low level counters and organic counters is that the NaI crystal has a much higher resolution; therefore, one can identify unknown isotopes with a high degree of precision. The organic counters do not possess this high resolution, but on the other hand have a much higher geometric efficiency. This geometric efficiency can be obtained with a large number of NaI crystals, but the high cost makes it impractical. In counting, because of the higher geometric efficiency of the organic counters, a determination of the natural K in a human body can be made in about two min with a precision of 2 to 3%, while for the same measurement with a large NaI crystal 40 min or more are required. When many subjects are to be measured, the advantage of rapid determination is very important. This is particularly true when large numbers of people must be checked for contamination. If contamination is found, they can then be examined in a NaI whole-body counter where exact amounts and kinds of isotopes can be identified. In biological and medical applications, low level γ counters are important because: (1) much smaller doses of isotopes can be used for diagnostic purposes, perhaps in the order of 1/10 to 1/100 the doses required with other means; (2) children and pregnant women can benefit from the new techniques of the radiodiagnosis because of these lower doses, and (3) easily manageable doses of isotopes can be used with lab animals. (BBB)

28153 THE ESTIMATION OF TOTAL DOSE FOR DIFFERENT NUMBERS OF FRACTIONS IN RADIOTHERAPY. J. F. Fowler (Postgraduate Medical School, London). Brit. J. Radiol., 38: 365-8(May 1965).

Calculations of total doses for different numbers of fractions are presented, for two special assumptions. One is based on published radiotherapy results, on normal tissue reactions and cure of squamous-cell carcinoma, together with experiments on the skin of pigs and mice. The other is based on a cell survival curve model with extrapolation number = 2.8 and D_0 = 140 rads. Neither assumption allows fully for cell repopulation, and the significance of this is discussed. The limitations of the calculations as a guide to radiotherapeutic practice are stressed. (auth)

28154 THE COMPUTATION OF TWO AND THREE DIMENSIONAL DOSE DISTRIBUTIONS IN COBALT 60 TELETHERAPY. J. van de Geijn (H. Joannes de Deo Hospital, The Hague). Brit. J. Radiol., 38: 369-77(May 1965).

A theoretical description is presented of the dose distributions in rectangular beams of ^{60}Co radiation in a water-equivalent medium. This theory, supported by experimental results, allows the determination of three-dimensional dose distributions produced by crossfiring techniques using either stationary (including wedged) beams or moving beams. This method was specially developed for use with a computer. It appears that, per radiation machine, relatively little preparatory work is involved. There are strong indications that this system is valid for any ^{60}Co machine as well as for x-ray machines in the equivalent energy range. (auth)

28155 ENDOLYMPHATIC THERAPY WITH RADIOACTIVE GOLD FOR MALIGNANT MELANOMA. G. H. Jantet, J. M. Edwards, M. H. Gough, and J. B. Kinmonth (St. Thomas's Hospital Medical School, London). Brit. Med. J., 2: 904-6(Oct. 10, 1964).

Details of the use of ^{198}Au in 13 patients with malignant melanoma are presented, with data on dose considerations, distribution of the isotope, complications, and clinical results. To obtain a high concentration of activity in the lymph nodes the calculated dose of ^{198}Au was given slowly over about five min; the volume injected ranged from 0.25 to 2.8 ml. It had a physical half-life of 2.69 days, and the size of the particles ranged from less than 50 to about 225 Å, the overall mean being 66 Å. Most of the radioactivity was carried by those in the 100 to 125 Å range. The dose required was calculated from the β-particle dosimetry formula. The same formula can also be used to calculate the dose actually received by the nodes in patients after removing the nodes, weighing them, and measuring their radioactivity. In two patients in whom the nodes could be removed after injections of 30 mC ^{198}Au into each leg, estimated levels of 26,500 and 35,000 rad were obtained in certain selected points in the excised inguinal nodes. Thus a high concentration of gold and strong selective internal irradiation can be obtained in the lymph nodes. The γ dose makes a small contribution and may be ignored, as it may also in relation to radiation necrosis. At first, radiation levels in the lymph nodes of about 20,000 rad were aimed at, but this level was gradually raised, and in later patients levels of about 70,000 rad were given. The quantity of ^{198}Au injected therefore varied from 16 mC in the early patients to 70 mC in later patients. External scanning of the patients following injections showed the radioactivity to be concentrated along the lymph vessels and nodes draining the primary site. After injections in the leg the max activity usually centered in the ilioinguinal or paravertebral nodes. Some patients showed concentration of activity in nodes near the termination of the thoracic duct. The follow-up of the 13 myeloma patients, all of whom are surviving, is from $1\frac{1}{2}$ to 5 years. None of the 13 patients has developed lymph-node metastases; 11 patients are alive and free from recurrence. Two complications were encountered. One patient had a temporary depression of the bone marrow from which she made a full recovery; she had previously been heavily irradiated for a lymphosarcoma of one adenoid. Another patient developed a 2.5-cm area of radionecrosis of the skin at the site of injection of the gold following leakage (this had to be excised and the defect grafted). Three had edema which was not progressive. It is probably secondary to fibrotic changes in the nodes following the gold injection. (BBB)

28156 SUPERIOR MEDIASTINAL OBSTRUCTION TREATED WITH DEMECOLCINE FOLLOWED BY RA-

DIOTHERAPY. Maurice Sutton (North Middlesex Hospital, London). Brit. Med. J., 1: 495-6 (Feb. 20, 1965).

A clinical trial to test the effect of combining demecolcine with radiotherapy is described. To determine the time interval elapsing between administration of demecolcine and maximum mitotic arrest, four patients with accessible tumors were given the drug and biopsy specimens were taken at frequent intervals following this. It was found that maximum mitotic arrest occurred 4 hr after administration of demecolcine by mouth. Twenty patients with superior mediastinal obstruction from carcinoma of the bronchus were treated by a daily dose of demecolcine followed after four hours by radiotherapy. The radiotherapy was given with a 240-kv machine, and the mediastinum was irradiated to a dose of 2400 Rad in three weeks. Demecolcine (5 mg) was given orally five days a week. Blood counts were carried out twice a week. Demecolcine was discontinued if the white blood cells fell below 2000/mm^3. This occurred in two patients in the third week of treatment, and the blood count soon recovered after the drug had been stopped. One of these patients suffered transient loss of hair also, but no diarrhea or vomiting was recorded. The initial response to radiation was regarded as complete if all signs and symptoms of obstruction disappeared during or soon after treatment. On this basis 15 patients responded completely, three incompletely, and in two there was no response. There appeared to be an improvement in results when demecolcine combined with radiotherapy was compared with radiotherapy alone. (TCO)

28157 ANALYSIS OF DATA FROM A SYSTEM OF ASSESSMENT OF THE GONADAL RADIATION DOSE DURING RADIOGRAPHIC PROCEDURES. H. E. Duggan and G. L. Olde (Univ. of Alberta, Edmonton). Can. Med. Assoc. J., 92: 1051-6(May 15, 1965).

The radiation hazard, if any, from diagnostic x-ray examinations was assessed in a study divided into three phases: the gathering of data to allow estimation of the total gonadal dose received by each patient; the accumulation of the individual and accumulative gonadal-dose totals on a large group of patients; the examination and follow-up of patients who had received a substantial gonadal dose to determine any relationship between small recurring doses of ionizing radiation and various indices of somatic and genetic damage. The mean gonadal dose received by females was much higher than that received by males, 1012 mR as compared to 310 mR. Of 7021 individuals in this study, only 428 (6.1%) received 2 R or more during the three-year test period. No definite conclusions as to radiation hazard could be made. A system, however, was developed which, if continued, could eventually produce this basic information. (auth)

28158 CARCINOMA OF THE THYROID AND LARYNGOPHARYNX FOLLOWING IRRADIATION. A REPORT OF 3 CASES. R. W. McGraw and A. D. McKenzie (Vancouver General Hospital, British Columbia; Univ. of British Columbia, Vancouver; and British Columbia Cancer Inst., Vancouver). Cancer, 18: 692-6(June 1965).

Literature relevant to irradiation as a thyroid carcinogenic factor was reviewed. Reported are 3 cases who received irradiation for benign cervical conditions followed by the development of 2 distinct cancers, laryngopharyngeal and thyroid, in the field of irradiation. It was concluded that the laryngopharyngeal and thyroid cancers in all 3 were related to the earlier irradiation. The lengthy period (average 33 years) after irradiation before the development of thyroid carcinoma was noted. The suggestion is made that another 15 years will be required before the safety of radioactive iodine in diagnosis and treatment of thyroid disease reasonably can be assumed. (P.C.H.)

28159 HIGH-ENERGY RADIATIONS: COBALT TELETHERAPY. A. Tardy (Ospedale Maggiore, Turin). Cancro, 16: 414-21(1963). (In Italian)

Physical properties of ^{60}Co γ radiation and conventional radiotherapy beams were compared with advantages and disadvantages of each discussed in terms of clinical results. (BBB)

28160 THE DETERMINATION OF CORONARY FLOW EQUIVALENT WITH COINCIDENCE COUNTING TECHNIC. Richard J. Bing, Arvin Bennish, Gerhard Bluemchen, Alberto Cohen, James P. Gallagher, and Edward J. Zaleski (Wayne State Univ. Coll. of Medicine, Detroit). Circulation, 29: 833-46(June 1964).

A principal disadvantage of methods employing ^{86}Rb in the measurement of coronary blood flow is the difficulty in determining the specific activity of the heart muscle alone, as separate from the structures surrounding it. Accurate assessment of the relation between the coronary flow, the percentage extraction of ^{86}Rb by the heart, the heart rate, and the myocardial uptake of the isotope is lacking. This report redefines these relations and evaluates the measurement of myocardial clearance by a coincidence counting method with ^{84}Rb, a positron emitter. Rubidium-84 decays by positron (β plus) emissions 19% of the time. The positron travels a few millimeters inside the body before annihilation with a negative electron, thereby producing two γ photons of 0.51 Mev directed 180° apart. A pair of scintillation detectors are utilized, also placed 180° apart. Only events resulting from simultaneous (coincident) detection of the 0.51-Mev γ rays, one in each detector, are counted. This is in contrast to the so-called singles technic that is employed when ^{86}Rb is used. It decays by β-negative (electron) emission; the electron, having a short range, goes undetected. However, 8.8% of these decays also result in 1.08-Mev γ photons, which are detectable with a single scintillator. Use of this singles technic requires heavy lead collimation around two scintillation crystals to limit their field of view, because of the high penetrating power of γ radiation. In contrast, the coincidence counting technic does not require lead collimators because the requirement of coincidence counts and the back-to-back production of the annihilation γ-rays automatically restrict detection to positron decays arising only within the cylinder defined by this coincidence pair of detectors. Clearance of ^{84}Rb in patients was measured by a specially designed instrument, consisting of two pairs of coincidence detectors with 3-in. by 2-in. thickness of NaI crystals and a conventional well counter for continuously monitoring arterial specific activity. In experiments on isolated dog heart it was found that changes in rate of perfusion of the coronary arteries failed to influence the myocardial extraction ratio of ^{84}Rb. Alterations in heart rate were also without effect. Nitroglycerin increased the clearance equivalent of ^{84}Rb in patients without coronary heart disease. In patients with coronary artery disease the drug led to fall in clearance equivalent. The method was helpful in distinguishing between normal individuals and those with coronary artery disease. It is concluded that this technic makes possible a distinction of radioactivity of the heart muscle from the surrounding tissue, eliminates lead collimation, and is more sensitive than the singles technic. (BBB)

28161 THEORETICAL ASPECTS OF DOSE-TIME FACTORS IN RADIOTHERAPY TECHNIQUE. D. K. Sambrook (Swansea Hospital, Wales). Clin. Radiol., 14: 290-7(July 1963).

The changing concepts of cellular radiosensitivity are discussed and applied to a consideration of fractionation techniques in tumor irradiation. Most radiotherapists have accepted the idea that, in general, cancer cells are more radiosensitive than normal tissue cells. Some tumors were assumed to be more radiosensitive than others, and a whole spectrum of tumors of varying radiosensitivities was constructed. However, this simple and convenient theory, based on clinical observation, has been called seriously into question recently and it now appears that all mammalian cells, normal and malignant, may be roughly equal in sensitivity in certain important respects, with few exceptions. Fractionation reduces the effectiveness of radiation with respect to loss of reproductive integrity, and the smaller the fractions, the greater the loss of effect. It is, therefore, not enough simply to consider the total tumor dose; the number and size of individual fractional doses into which it is

divided must also be considered. The loss of effectiveness with fractionation cannot be compensated for simply by giving a larger total dose, because there will be a disproportionate loss of effectiveness in sterilizing cells which are anoxic, or hypoxic, and probably also polyploid cells, which may well have a dose-response curve with higher extrapolation numbers. Unfortunately, it is just these conditions which are likely to obtain in malignant tumor cells, so that fractionation will tend seriously to reduce the therapeutic ratio of the radiation given. Some examples of the effect of fractionation under various conditions of hypoxia and anoxia are given. For mixtures of aerobic, hypoxic, and anoxic cells, dose-response curves are computed. Examples of dose-response curves for mixed cell-populations with single doses are illustrated. Once the aerobic cells have been reduced to one-tenth the surviving fraction of the anoxic cells, the rest of the curve virtually follows the anoxic pattern. An analysis of the effect of fractionated dosage on such a mixed population shows that the anoxic tumor cells soon dominate, and will determine the ultimate surviving fraction. When treatment is fractionated in 500-rad fractions, even 1% anoxic cells soon reduce the dose-response slope to the slope for 100% anoxic cells (although the total dose required, for a given depopulation, is 3000 rad less). The smaller the fractional dose, the less the slope of the dose-response curve. A graph illustrates this, where it is seen that the log S (surviving fraction) curves for 500 rad fractions actually cross the log S curves for 250 rad fractions (at 5000 rad), even though the initial population contained ten times the ratio of anoxic cells. Unless blood supply and oxygenation can change during the course of treatment, this effect is a strong objection to fractionated techniques. (BBB)

28162 THE BLOOD VOLUME IN POLYCYTHEMIA VERA AND ITS CHANGE DURING TREATMENT. A CLINICAL CONTRIBUTION TO THE PROBLEM OF BLOOD VOLUME REGULATION. Hansjoerg Becker (Universitat, Frankfurt am Main). Folia Haematol. (Frankfurt), 7: 256-90(Oct. 1963). (In German)

Studies were conducted on 44 previously untreated cases of polycythemia to determine the effect of ^{32}P administration and/or venesection. The doses of ^{32}P, given intravenously, were about 5 mC. An increase in volume of erythrocytes is characteristic in untreated polycythemia. If the increase is not of a high degree, a decrease in the plasma volume occurs at the same time, only slightly increasing the blood quantity. The hematocrit value is higher in such cases, as would correspond to the increase in the volume of erythrocytes. In cases in which the increase in the volume of erythrocytes is higher, the volume of plasma is about normal, but is clearly increased with an extremely large quantity of erythrocytes; the blood quantity also has increased. If the erythrocyte volume is therapeutically decreased, a tendency to maintain the size of the blood volume is observed. If the increase in erythrocyte volume had been previously compensated by a decrease in plasma volume, then a normalization of erythrocyte and plasma quantity is achieved. If a marked hypervolemia existed before treatment, a further increase in plasma volume occurs with a decrease in erythrocyte volume. The blood volume remains much above the normal value as a result of plasma plethora which could persist for months. In these cases, the hematocrit value is low when compared with the erythrocyte volume. Due to the variation in plasma quantity, the blood volume adapts itself to the given capacity of blood vessels. The maintenance of optimal relation between blood volume and the vascular capacity is of greater importance than regulation which only aims at the normalization of the cell concentration. (BBB)

28163 THE USE OF WEDGE AND COMPENSATION FILTERS IN THE SUPER-VOLT THERAPY OF GYNECOLOGICAL CARCINOMAS. U. Rosenow and R. Frischkorn (Universitat, Gottingen, Ger.). Fortschr. Gebiete Roentgenstrahlen Nuklearmed., 102: 579-85(May 1965). (In German)

An account is given of the way in which filters may be used to influence the dose distribution of Co gamma-sources. The filters serve to straighten the isodoses at a certain depth, to compensate the effect of oblique incidence, to produce angles of intersection between central ray and isodoses different from 90 degrees; and to compensate for the influence of uneven skin fields on the dose distribution. In the latter case the filters are made with the help of a specially constructed probe. (auth)

28164 CANCERS OF THE ORAL CAVITY AND FACE. II. RADIOTHERAPY OF SKIN CANCER. G. R. Prager. Geneesk. Gids, 42: 399-400(Sept. 17, 1964). (In Dutch)

Dose factors and development of complications in irradiation of skin cancers are considered. (BBB)

28165 USE OF ISOTOPES FOR DIAGNOSIS OF THYROID DISEASES. A. Vannotti, B. Scazziga, and Th. Lemarchand-Beraud (Universitaire, Lausanne, Switzerland). Helv. Med. Acta, 31: 335-44(Nov. 1964). (In French)

Uses of ^{131}I in various techniques to evaluate thyroid activity are reviewed. (BBB)

28166 ISOTOPE DIAGNOSIS IN HEMATOLOGY. P. G. Frick and H. E. Brunner. Helv. Med. Acta, 31: 345-59 (Nov. 1964). (In German)

The techniques and the clinical value of diagnostic tests using ^{51}Cr, ^{59}Fe, and ^{58}Co-vitamin B_{12} are reviewed. (BBB)

28167 INTEREST AND LIMITS OF EXAMINATION WITH COLLOIDAL RADIOACTIVE GOLD IN THE STUDY OF SOME LIVER DISORDERS. J. Stroun, F. Meykadeh, C. Laperrouza, and P. Wenger (Centre de Radioactivite Medicale, Geneva). Helv. Med. Acta, 31: 594-603(Nov. 1964). (In French)

Techniques and results of the use of colloidal ^{198}Au in liver scintiscanning are described. In contrast to ^{131}I-labeled Rose Bengal, used for liver scanning, which is rapidly excreted, ^{198}Au is phagocytized by the liver Kupffer cells. With a diameter of 200 Å, about 90% of the particles are taken up by these cells after intravenous injection, and this proportion varies with different liver diseases. The remainder of ^{198}Au particles are taken up by extrahepatic reticuloendothelial cells. With an injection of 100 μC of ^{198}Au, an estimated radiation dose of 4.0 to 4.5 rad is received. The isotope has a half life of 2.7 days and emits both β and γ radiation. The γ radiation permits external registration of reticuloendothelial-cell ingested radioactivity by scanning procedures. For liver scintiscanning, intravenous doses of 150 to 250 μC of ^{198}Au were used. Fractional clearance (K) values determined in 18 patients were: (for normal adults) blood, 0.235; head, 0.223; thigh, 0.204; hand, 0.195; aortic trunk, 0.301; liver, 0.247; in compensated cirrhosis the values were: liver, 0.161; hand, 0.130. The difference in mean K values between normal and cirrhotic liver was highly significant. Thus, the fractional clearance of the cirrhotic liver averages only 16% compared with 23.5 for normal; for hand the averages are 13% and 19.5%. The distribution of γ activity in the liver can be used to detect cysts and tumors, primary and metastatic, in the liver. A series of scans illustrating various liver disorders are shown. Advantages of this technique over other methods are enumerated. (BBB)

28168 RENAL TRANSPLANTATION IN THE RHESUS MONKEY. IV. CORRELATION OF RENAL ALTERATIONS WITH THE RADIOISOTOPE RENOGRAM. Gerald S. Johnston and Gerald P. Murphy (Walter Reed Army Inst. of Research, Washington, D. C.). Invest. Urol., 2: 286-91(Nov. 1964).

Neohydrin labeled with ^{197}Hg or ^{203}Hg was used to follow renal distribution, scintiscans, and renograms to test effective renal function in 10 renal auto and homotransplants in the monkey. A simple, repeatable, and reliable screening test was sought to determine the functional status of the transplanted kidney. Hippuran-^{131}I renograms have been used in postoperative renal transplant patients, and reported as being capable of detecting function even in anuria. However, there has always been some disagree-

ment as to what the various phases of the Hippuran renogram indicate. A recent study which evaluated ^{197}Hg-Neohydrin as a measure of renal function in the dog showed that in a variety of situations both this agent and ^{203}Hg-Neohydrin are a valid indicator of total renal functional mass. The radiomercury renogram, in addition, provides a scintiscan which gives a precise topographical information concerning the renal mass. The simplicity and rapidity of the test, in addition to its validity, as shown experimentally, recommended its use, following experimental renal transplantation in primates. Ten female rhesus monkeys (Macaca mulatta), previously employed as subjects for renal homo- and autotransplants, were studied. The animals were given intravenously 30 μC of either ^{197}Hg-Neohydrin or ^{203}Hg-Neohydrin from 10 min to 147 hr prior to sacrifice or death. Renal scintiscans were performed with a Picker Magnascanner, fresh renal cortical and medullary tissue was assayed for radioisotope content in a well counter, and cpm/g of renal tissue were determined. The radiomercury Neohydrin scintiscan and renogram correlated well with renal blood flow and urine flow rate. The demonstrated accuracy and simplicity of these tests in the transplanted kidney suggest a reliable clinical aid in transplantation to assess renal performance. In patients, these techniques can easily be serially repeated in a single subject using ^{197}Hg, which has a half-life of only 2.7 days, and does not give an excessive radiation dose to the kidneys in the amounts necessary for renography and renal scanning. (BBB)

28169 EXODONTIA AFTER IRRADIATION OF THE JAWS: REPORT OF CASE. Peter J. Cavallo (Univ. of Tennessee, Memphis). J. Am. Dental Assoc., 69: 551-3 (Nov. 1964).

Endodontic therapy was substituted for extraction of a tooth from a heavily irradiated region of the mandible in a patient because of the risk of osteoradionecrosis. The treatment was effective since the patient's symptoms were relieved, and repair of bone was demonstrated. Although usually the teeth should be removed before administering ionizing radiation at the dose level needed in the cancer treatment, the present case was treated in 1956 for a glomus jugulare tumor and was told not to have teeth extracted. He first received radiation in 1956 for about a month; x rays were directed through two ports using 250-kv with 2-mm copper and 1-mm aluminum filters. The preauricular port received 2200 R, and the postauricular area an air dose of 1200 R. It was estimated that the mandible received a total dose of 2100 R. About five years later, a second course of radiation was given through similar ports with ^{60}Co over a 17-day period. The preauricular port area received an air dose of 2450 R, and the postauricular port area an air dose of 2450 R. It was estimated that the mandible received a tissue dose of 3000 R in this treatment course. The total radiation dose to all or part of the left molar region from both courses of radiation was 5100 R. Endodontic therapy was initiated; penicillin, bacitracin, streptomycin, and sodium caprylate were sealed in the lower left first molar. Successful healing resulted. (TCO)

28170 MODERN RADIOTHERAPY OF NEOPLASTIC DISEASE. L. Henry Garland (Univ. of California, San Francisco). J. Am. Geriat. Soc., 12: 1011-21(Nov. 1964).

Advantages of radiotherapy over other treatments and of some types of radiation over other types, dose considerations, and radiosensitivity and curability factors of various kinds of tumors are discussed. It is estimated that radiotherapy can or should be employed at some time in the care of about two-thirds of patients with cancer — in selected patients with localized cancer, for cure; in more advanced or metastatic cases, for palliation. Compared with surgery, irradiation generally gives: (1) better cosmetic results in cancer of the eyelids, (2) better functional results in cancer of the lip, tongue, or larynx, (3) better clinical results in cancer of the cervix, in lymphoblastoma, and in medulloblastoma. It may also provide greater safety in selected patients who are poor surgical risks. It is pointed out that the skin is not the limiting factor in delivering a desired dose of radiotherapy to a tumor situated at a depth. The limiting factor is the tolerance of the normal tissues in the path of the direct beam or those adjacent to the tumor, for example the lung, pericardium, intestinal epithelium, and spinal cord. With orthovoltage units (200 to 300 kv) it is usually possible to deliver all the radiation that the normal deep tissues will tolerate without permanent serious skin damage. Megavoltage is only advantageous for radical therapy of deep-seated tumors in very obese or thick-set patients, or of rare localizable small tumors such as retinoblastoma. It may also be preferred in certain patients who have previously received inadequate doses of lower voltage therapy or whose skin overlying the tumor has sustained injuries. The disadvantages of megavoltage include lack of flexibility, lack of visible evidence of a full-dose effect (the maximal ionization being subcutaneous), and the increased risk of late undesirable effects on deep structures (e.g., sigmoid fibrosis, gastric ulceration, and neurologic injury). For localized cancers of small volume (<3 cm dia) comparable carcinocidal tissue doses (using orthovoltage x rays) are 2200 R in one day, 4200 R in six days, and 6000 R in 30 days, with equal fractionation of the doses over six or 30 days. There is experimental and clinical evidence that fractionation by treatment every second day may be radiobiologically superior to daily fractionation. This is under investigation. In palliation of advanced cancer, two or three main courses may be optimal, for example, a tumor dose of about 2000 rad delivered in two or two and a half weeks; then two weeks rest is followed by a second course of radiotherapy equal to or slightly larger than the first. Specific doses and techniques for various kinds of cancer are outlined. The author is of the general opinion that megavoltage techniques offer few advantages over orthovoltage x rays in the treatment of most patients. (BBB)

28171 PALLIATIVE RADIATION THERAPY. Robert G. Parker (University Hospital, Seattle). J. Am. Med. Assoc., 190: 1000-2(Dec. 14, 1964).

Use of radiation on metastatic cancer is discussed in terms of radiosensitivity of various histologic types. Better understanding of biological responses of cancer and supervoltage equipment permit the administration of greater doses with less treatment produced discomfort. Improved ancillary care makes palliative treatment reasonable in new situations. Therefore, continued revision of indications and contraindications is to be expected. Response to radiation is reasonably well related to tumor type. Many tumors secondary in bone are very radiation sensitive. These include neuroblastoma, lymphoma, and small-cell bronchial carcinomas. Rapid, complete pain relief and control of the local lesion can be expected with small dosage. Bony metastases from differentiated carcinomas of the prostate, thyroid, renal parenchyma, and bronchus exhibit lesser responses, even with higher dosage. Treatment of histologically well-differentiated metastases from carcinoma of the cervix, endometrium, pancreas, and gastrointestinal mucosa, even with high doses, is usually unsuccessful. Therefore, use of radiation rarely can justify delay in use of methods more rapid and certain in their response. Primary tumors of bone have a broad spectrum of response. Osteosarcomas and chondrosarcomas are poorly responsive, although irregular response of components of these tumors may result in significant pain relief. Ewing's tumor can be locally sterilized with small doses of radiation. Use of radiation to destroy tumors in specific body sites is also considered. (BBB)

28172 ANESTHETISTS' EXPOSURE TO RADIATION DURING RADIUM IMPLANTATION PROCEDURES. Howard A. Trachtenberg and Eliot M. Slater (Massachusetts General Hospital, Boston). J. Am. Med. Assoc., 191: 763 4(Mar. 1, 1965).

The amount of radiation to which the anesthetist is exposed during Ra implantation for carcinomas of the uterine cervix and oral cavity was measured by indirect-reading pocket chambers. A pair of pocket chambers was worn at chest level and another pair at waist level. The mean dose to which the anesthetist was exposed during Ra implanta-

tion in the pelvis was 12 mR at chest level with a range of 0 to 26 mR, and 9 mR at waist level with a range of 0 to 22 mR. The corresponding measurements during Ra implantation in the oral cavity were 25 mR at chest level with a range of 8 to 50 mR, and 19 mR at waist level with a range of 0 to 35 mR. The mean amount of Ra employed for implantation in the pelvis was 91 mg, and 11 mg in the oral cavity. The mean time for the procedures was 23 min for pelvic implantation and 37 min for oral implantation. The mean distance of the anesthetist from the radiation source was 5.5 ft during pelvic implantations and 3.5 ft during oral implantations. Thus during implantation in the oral cavity, the dose received by the anesthetist was slightly more than double that received during pelvic implantation, although the amount of Ra used in the pelvis was eight times greater than that used in the mouth. The closer proximity of the anesthetist to the Ra during oral implantations is the major factor in the higher exposure received by the anesthetist during this procedure. The other factor was the significantly longer period of exposure during oral implantations. The Radiation Protection Guide recommended by the Federal Radiation Council is 3 rem per 13 weeks' whole-body exposure or an accumulated dose of 5 (18-age in years) rem. The radiation doses measured during the present study fall below these values. The anesthetist is exposed to similar amounts of radiation (5 to 25 mR) during diagnostic x-ray procedures in the operating room such as cystography, bronchography, angiography, cholangiography, and hip nailings. In centers where large numbers of these procedures are done, anesthetists' schedules should be rotated so that no single individual receives excessive dosages from repeated exposure. Adequate shielding, with lead blocks if possible, should be used. (BBB)

28173 THYROID SURVEY BY ISOTOPE TECHNIQUES. Philip Shtasel (Metropolitan Hospital, Philadelphia). J. Am. Osteopath. Assoc., 63: 622-8(Mar. 1964).

Diagnosis of thyroid disorders with ^{131}I, utilizing various techniques, is considered with reference to results obtained in 500 cases. Three procedures, of the numerous ones available, are recommended as providing the most data: the 24-hr thyroid ^{131}I uptake, the conversion ratio, and the thyroid scan. Many investigators advocate that the measurement of the iodide or trapping phase of metabolism be made at different time intervals. Recommendations range from the 10-min interval following intravenous injection of ^{131}I to the 72-hr interval following oral ingestion. However, on a routine basis, the 24-hr uptake provides the most satisfactory and consistent results. This study should be coupled with a technique that measures the phase of organic binding of ^{131}I and release of hormone. This phase can best be evaluated by the 24-hr conversion ratio. Measurements of the conversion of trapped iodide to organically bound hormone are generally more reliable than tests of uptake alone. Of the many modifications available, the triiodothyronine (T_3) suppression test and the T_3 uptake determination are recommended. The third routine includes scanning of the anterior neck. The scan offers information that can not be obtained in other ways. Some representative scans are used to illustrate and demonstrate the clinical value of this examination. These cases show that the scan can only indicate the physiologic nature of a defect. Not all cold nodules are malignant and, differentiation cannot be made between these and benign lesions. However, the ability to screen potential malignant processes is far advanced over the other methods. Another facet of scanning is the search for metastasis from a primary lesion. If the lesions take up ^{131}I, therapy with ^{131}I is possible and of excellent palliative value. (BBB)

28174 MULTIMILLION VOLT X-RAY AND ELECTRON BEAM THERAPY. R. Kenneth Loeffler. J. Am. Osteopath. Assoc., 63: 717-27(Apr. 1964).

The construction, specifications, operating characteristics, and use in radiotherapy of electron accelerators (betatrons giving beam energies up to 35 Mev) are extensively described. Various models are illustrated and their operation explained in detail. The clinical advantages of 25-Mev x-ray therapy are the result of improved physical characteristics: greater depth dose, decreased skin dose, decreased scatter, and minimal differential absorption among the various tissues, as compared to x rays of lower energies. The radiation dose distribution from a beam of 250-kvp x rays compared with the 25 Mev beam is diagramed. The 10-cm depth dose is 81% for a 7×7 cm betatron field, compared with 30% for conventional radiation and 53% for ^{60}Co. The isodose pattern is shown for a 25-Mev x-ray beam, demonstrating these characteristics quantitatively. As the energy of the radiation increases beyond 25 Mev the max dose continues to be displaced deeper, but the penetrability of the x-ray beam itself gradually becomes less, differential absorption begins to return, and the beam becomes much narrower. These physical factors make it unlikely that x rays above 25-Mev will be used clinically to any appreciable extent. The radiation dose distributions are compared in various clinical situations. Tissue tolerance to this high-energy radiation is discussed. Early animal research with x rays in this energy range indicated that the relative biologic effectiveness was only about two thirds that of 250-kvp radiation. However, those who have used 20- to 25-Mev radiation clinically have suggested that the biologic difference, if any, is less than 10%. Mucous membrane reactions after administration of a 1000-R tissue dose per week rarely extends to mucositis, the reaction usually being limited to a brisk erythema; 1200 R/week will usually produce a patchy mucositis, reaching its peak about the third or fourth week of therapy and frequently subsiding somewhat if therapy continues; whereas 1400 to 1500 R/week will cause a confluent mucositis by about the tenth day, which usually subsides in 2 weeks following the completion of therapy. Tissue and tumor radiosensitivity data for 25-Mev radiation is also discussed. Some soft-tissue sarcomas, such as fibrosarcoma, myosarcoma, and chrondrosarcoma, are usually much more radioresistant than are the surrounding normal tissues. Little or no improvement in curability can be expected from alteration in the physical distribution of the radiation. Liposarcoma appears to be more controllable with higher but tolerable doses. Treatment schedules and dose distribution data for various types of tumors are described. A major advantage of multimegavoltage radiation is the simplicity of planning and administering the treatment. It is rarely necessary to use more than two or three portals to treat a given volume satisfactorily, and many regions can be readily treated with a single portal. It is concluded that x rays of 25 Mev and electrons of 10 to 25 Mev, emitted by the dual-beam 25-Mev betatron, can be used to obtain radiation distributions which cannot be produced by lower-energy x-ray beams. Because of this improved physical flexibility, greater control of malignant disease has been achieved in some regions of the body, especially about the head and neck, breast, and pelvis. Most patients tolerate the therapy with fewer reactions. (BBB)

28175 TECHNICAL PROBLEMS OF HIGH-ENERGY IRRADIATION IN CANCER OF UTERINE CERVIX. J. M. Debois, M. De Roo, J. Bonte, and A. Baert. J. Belge Radiol., 48: 92-108(1965). (In French)

Irradiation of the pelvis is an important element in the treatment of cancer of the uterine cervix. The topography of the uterus, of the lymphatic pathways, and of other pelvic organs partially determines the dose distribution in external irradiation with multiple fields. Interposition of the bony pelvis is also important. The physical characteristics of high energy x rays again raise technical problems already partially solved for conventional radiotherapy. The most favorable field disposition is found, provided the topographical data, energy, and osseous absorption are taken into account. Local application of radium or other radioactive sources favorably completes external irradiation. Higher tumor-dose, obtained by high energy, necessarily imposes a reduction of the complementary curie-therapy. (auth)

28176 CAN IRIDIUM-192 REPLACE RADIUM? B. Pierquin (Institut Gustave Roussy, Villejuif, France). J. Belge Radiol., 48: 109-19(1965). (In French)

A comparative study between the conditions of application of radium and iridium-192 showed the most important advantages resulting from the substitution of ^{192}I for radium. The future of endo- and plesiotherapy seemed to have come to a dead end with the use of radium, whereas ^{192}I opens new prospects for the development of the clinical applications of endo- and pleisotherapy. Indeed, it appears that, at the time being, alone this artificial radio element warrants both the effective protection required and the possibility of development of curietherapy. It seems justified that, in 1964, radium may be progressively suppressed and replaced by ^{192}I in all radiotherapic departments. (auth)

28177 WHOLE-BODY COUNTING OF ^{131}I-LABELED TRIIODOTHYRONINE. D. A. Fisher and T. H. Oddie (Univ. of Arkansas, Little Rock). J. Clin. Endocrinol. Metab., 24: 733-9(Aug. 1964).

Absorption and degradation rates of ^{131}I-labeled triiodothyronine (T3) were measured in human subjects by the whole-body counting methods previously used for ^{131}I-thyroxine (T4). Results obtained in 18 euthyroid subjects showed a significant difference in the ratio of 0- and 4-hr counting sensitivity of T3 as compared with T4, suggesting significantly different spatial redistribution of T3 and T4 in the whole body during this time. The variation in T3 counting sensitivity related to body weight was similar to that found with T4. An average of 85% of an oral dose of T3 was absorbed. The T3 degradation rate was similar after oral and intravenous administration. However, after oral administration a significant time delay was observed before apparent degradation of T3 began. This was attributed to temporary hepatic sequestration of the oral dose. Fecal excretion of the administered T3 label (mean 10.4%) and fecal lag time (1.3 days) were similar to values observed using T4. The mean degradation rate of T3 after intravenous administration was five times greater than the value for T4. The apparent mean volume of distribution of T3 was 31 ± 1 compared with a mean volume of 9.5 ± 1 for T4. The possible significance of these values in terms of the reported ratio of daily thyroxine iodine secretion to daily thyroxine iodine degradation rate (TSR/TDR) of 1.6 is discussed. It is concluded that the whole-body counting technique, when applied to T3 studies, is subject to some variations arising from erratic stool excretion, which can become an important factor for materials with a rapid biological rate of turnover. (BBB)

28178 THERAPEUTIC HYPOPITUITARISM INDUCED BY STEREOTAXIC TRANSFRONTAL IMPLANTATION OF YTTRIUM-90 IN PATIENTS WITH BREAST CANCER. V. Alfredo Jadresic, Mario Poblete, Alexander Reid, Melchor Riera, Aurora Matus, and Maria Herreros (Universidad de Chile; Hospital San Juan de Dios; and Hospital Psiquiatrico, Santiago). J. Clin. Endocrinol. Metab., 25: 686-97(May 1965).

Forty-three patients with breast cancer were submitted to stereotaxic transfrontal implantation of ^{90}Y under local anesthesia. No immediate deaths occurred. Four patients were implanted twice. The first 19 patients received doses ranging between 7.1 and 15.5 mc. Three showed visual damage due to high location of pellets in the sella turcica. The remaining 24 patients received doses between 18.1 and 23.4 mc, which were placed deep in the floor of the sella. No visual damage occurred. Eight patients presented with rhinorrhea, in 3 of whom it ceased spontaneously after 2 or 3 months; 2 others are under observation; and 3 presented with meningitis, one of whom recovered and 2 died. Necropsy of these patients showed destruction of the bone and bone marrow and devitalization of the epithelium in the sella and the sphenoidal sinus. Urinary gonadotrophins, ^{131}I thyroid uptake and response to Metopirone showed that complete hypopituitarism was obtained in 23 cases (62%). Hypopituitarism was considered incomplete in 14 cases (38%). Six patients were not fully studied. Necropsy studies were done in 9 patients, 2 of whom showed complete histological destruction of the gland. In the remaining patients destruction was estimated to be between 60 and 97%. Objective remission of metastases of breast cancer lasting more than 6 months occurred in 27% of the total series and in 35% of patients with complete hypopituitarism. The authors recommend a total dose of ^{90}Y of approximately 15 mc distributed in 8 or more small pellets to obtain complete destruction of the gland and placement of pellets at least 3 mm below the diaphragm of the sella and 2 mm above its floor to prevent complications. The procedure is considered a useful method for obtaining therapeutic hypopituitarism. (auth)

28179 RESPONSE OF CUTANEOUS LUPUS ERYTHEMATOSUS TO ULTRAVIOLET LIGHT. Mark Alien Everett and Robert L. Olson (Univ. of Oklahoma, Oklahoma City). J. Invest. Dermatol., 44: 133-4(Feb. 1965).

One minimal erythema dose (MED) of hot quartz uv light filtered through 2 cm distilled water was administered to clinically involved and uninvolved skin of eight patients with discoid or systemic lupus erythematosus. Biopsy specimens were obtained initially and at 12 and 72 hr. Sections were stained with hematoxylin and eosin and periodic acid-Schiff stains. In 3 of 8 patients one MED produced an increase in the size of the lesions of discoid lupus erythematosus. In one patient with the discoid form and 2 with systemic lupus erythematosus, there was a persistence of erythema at 72 hr. Uninvolved skin of these eight patients displayed no abnormal reaction to one MED of uv light. Mid-epidermal glycogen deposition was observed in lesions of lupus erythematosus both at 12 hr and at 72 hr. Basal cell glycogen did not appear. In areas uninvolved by disease, however, the usual sequence of glycogen accumulation was observed, i.e., in the basal cell layer at 12 hr and in the mid-epidermis at 72 hr. The absence of basal cell glycogen granules in lesions of lupus erythematosus suggests that where there is involvement by this disease the basal cell may be incapable of accumulating or producing significant quantities of glycogen. (BBB)

28180 RADIOTHERAPY IN ANGINA PECTORIS: A CONTROLLED STUDY. Elliot Senderoff, Harvey Peck, Robert Beck, Harry L. Jaffe, John Boland, and Ivan D. Baronofsky (Mount Sinai Hospital, New York). J. Mt. Sinai Hosp. N. Y., 31: 396-402(Sept.-Oct. 1964).

Preliminary to clinical trials an experimental study was conducted in dogs to determine the effect of local cardiac irradiation on coronary blood flow. This represents an attempt to obtain the protective benefits of myocardial revascularization without the necessity of surgical intervention, with possible use of cardiac irradiation as a therapeutic method in patients with coronary artery disease. Doses of 1300, 2000, and 2500 rad were given to the myocardium of mongrel dogs in three to five sessions of treatment over a two and a half week period. The dogs survived the treatment without noticeable effect. At varying intervals (from one week to six months) following irradiation, each dog was subjected to thoracotomy and the coronary circulation was studied. It was found that 8% of unirradiated animals survived ligation of the left circumflex coronary artery, and that 11% survived ligation of the anterior descending coronary artery. In contrast, in the animals previously irradiated, 40% of the dogs survived ligation of either vessel at one week after therapy. At six months after therapy, 75% survived ligation of the anterior descending coronary artery. These surviving irradiated dogs exhibited a better anastomotic flow. Electrocardiographic and pathological study of the irradiated heart revealed no evidence of damage either to the cardiac musculature or to the coronary vessels. In the clinical trials, 38 patients with severe angina pectoris were selected for a controlled study of the effect of radiotherapy on the angina. A total dose of 2250 rad of ^{60}Co γ radiation was delivered to the heart in 10 equal fractions over a two-week period. The study was so designed that half the patients acted as controls with every procedure conducted in exactly the same way as the treated patients. All patients were followed for at least 12 months. One observer

noted improvement in 14 out of 25 patients examined at 12 to 19 months following true or mock therapy, and no difference between the irradiated or control groups could be demonstrated. There was no deleterious effect of cardiac irradiation during or following its administration. (BBB)

28181 THE MEASUREMENT OF LOCAL BLOOD FLOW IN THE CEREBRAL CORTEX FROM THE CLEARANCE OF XENON[133]. A. M. Harper, H. I. Glass, J. L. Steven, and A. H. Granat (Glasgow Royal Infirmary). J. Neurol. Neurosurg. Psychiat., 27: 255-8(June 1964).

A recent technique for measuring local blood flow through the cerebral cortex, derived from the Fick principle, entailed the injection of ^{85}Kr into the carotid artery and the subsequent measurement of the rate of clearance from the brain of the β emissions of the isotope. As these have an average range in tissue of 0.7 mm, measurements of local blood flow can be made only on the exposed brain cortex. Another recent report describes the measurement of regional cerebral blood flow in man by monitoring the low incidence γ emissions of ^{85}Kr with a scintillation detector placed over the scalp. However, in that study uncollimated detectors were used in most patients, and the clearance of ^{85}Kr was recorded from almost one hemisphere of the brain. In the present report, substitution of the γ-emitting isotope ^{133}Xe for ^{85}Kr was made and the measurement of local blood flow conducted in a fairly small area of the cerebral cortex by external counting through the intact skull using a depth-focusing collimator. Measurements made in several patients who were undergoing cerebral angiography are described. Patients were injected with ~0.5 to 1.0 mC of ^{133}Xe in saline. The detector consisted of a focusing collimator, a 5-in dia NaI crystal, and a photomultiplier which was connected to a ratemeter and direct writing recorder. The collimator was lowered by a special stand on to the patient's scalp, when the center of the collimator lay above the posterior part of the frontal cortex. A catheter was inserted into the internal carotid artery via the common carotid artery, and about 10 to 15 ml of the saline solution ^{133}Xe was injected, rapidly at first, then more slowly into the cannula over $2\frac{1}{2}$ min. On completion of the injection, a clearance curve was obtained on the recorder. Xenon-133 has a biological half-life of only a few minutes and is cleared very rapidly from the lungs. The radiation dose to the lungs for a two-min rebreathing of a concentration of Xe of 1 mC/1 of inspired air is 70 mrad and the dose following an intravascular injection of 0.5 mC is much smaller. Patients undergoing cerebral angiography have about 20 skull radiographs taken, with a radiation dose to the skull of ~1.5 rad for each radiograph. This is many times more than the radiation dose received for each injection of ^{133}Xe. As the expired gas is led to the outside atmosphere, the radiation hazard to persons in the room is negligible. Results obtained with this method demonstrate its advantages over earlier methods using ^{85}Kr. (BBB)

28182 COMPARISON OF ISOTOPES FOR SCANNING. C. M. E. Matthews (Hammersmith Hospital, London). J. Nucl. Med., 6: 155-68(Mar. 1965).

A method of calculating the minimum tumor size detectable with a given isotope and counting system is presented. An experimental measurement with a phantom is required and also the tumor and normal tissue concentrations of isotope must be known. These concentrations may often be found in terms of extracellular spaces. In this way, different isotopes, collimators and counting systems may be compared quantitatively. This may be a useful method of evaluating the many new isotopes which are being used. Brain tumor localization is considered in detail, and it is found that a considerable gain may be obtained by using certain short lived isotopes. Owing to interference from radiation from the rest of the body, only positron emitters and low energy γ emitters can be used for brain scanning. The optimum collimator resolution is discussed and it is shown that this should not be less than about 2 cm, since tumors smaller than this cannot be detected with present conventional method. (auth)

28183 THE USE OF ^{125}IODINE FOR PRECORDIAL COUNTING. Ralph J. Gorten (Duke Univ., Durham, N. C.). J. Nucl. Med., 6: 169-74(Mar. 1965).

Precordial counting of ^{125}I albumin with small, light weight detectors for determination of cardiac output is reported. The system works well in human subjects with an unshielded and uncollimated wafer scintillation crystal. Radiation exposures are lower than with comparable doses of ^{131}I albumin. In 16 patients (62 determinations), including some with heart disease, cardiac output values measured with ^{125}I albumin and with ^{131}I albumin showed a high degree of correlation. (auth)

28184 EVALUATION OF A SIMPLE TECHNIQUE FOR ABRUPT INTRAVENOUS INJECTION OF RADIOISOTOPE. W. H. Oldendorf, Masami Kitano, and Shiro Shimizu (Veterans Administration Center, Los Angeles and UCLA, Los Angeles). J. Nucl. Med., 6: 205-9(Mar. 1965).

A simple, atraumatic technique of intravenous injection is described, which effects a dependably rapid deposition of isotope into the right heart. Venous distention is caused in the arm distal to a partially inflated cuff. A small needle is placed in an antecubital vein and the cuff pressure raised above systolic. Tracer is injected into the isolated venous pool. Abrupt release into the right heart is produced by sudden removal of the constricting cuff while still inflated. Averaged results on ten normal adult males subjects studied by this simple abrupt injection technique and later by simple rapid injection are compared using isotope passage through the cranial blood pool as the indicator of bolus compactness. The abrupt cuff-release method was shown to produce a more compact bolus than simple rapid injection. A total cranial detection system showed a head count which rises to a higher, sharper peak and falls off more rapidly. (auth)

28185 THE INTRODUCTION OF RADIOACTIVE PINS (Ir^{192}, Au^{198}) INTO THE VECTOR GROOVES. B. Pierquin. J. Radiol. Electrol. Med. Nucl., 46: 47-8(Jan.-Feb. 1965). (In French)

Techniques are discussed concerning a step first described by author. To make easier the introduction of the radioactive pins into the non-radioactive vector grooves, it is first necessary to twist slightly and laterally both extremities of the pin. Then, while maintaining firmly with a smooth forceps the double groove, 5 or 6 mm of one of the extremities of the pin are introduced, with the aid of a smooth forceps, into the corresponding groove, as indicated. The third step consists of making the other extremity of the pin slightly rotate so as to bring it within the second groove. At last, with the aid of a Reverdin's needle, the radioactive pin is pushed within the double-groove, while the latter is taken off with the forceps. In the hands of a trained physician, the introduction of a pin does not necessitate more than 15 to 30 seconds. (auth)

28186 CLINICAL AND EXPERIMENTAL STUDIES USING Hg-197 NEOHYDRIN AS A MEASURE OF RENAL BLOOD FLOW. Gerald S. Johnston, John N. Wettlaufer, and Gerald P. Murphy (Walter Reed Army Inst. of Research, Washington, D. C.). J. Urol., 92: 378-90(Nov. 1964).

The advantages of ^{197}Hg-Neohydrin over ^{203}Hg-Neohydrin and ^{131}I-Hippuran for kidney scanning, including the lower radiation doses required, are presented in a study designed to show how ^{197}Hg-Neohydrin is handled in the dog, rat, monkey, baboon, and man in relation to renal blood flow and urine production. The intrarenal as well as general organ distribution of ^{197}Hg-Neohydrin was studied. In addition, clinical correlation was obtained with other currently employed methods of assessment of renal function and blood flow in patients seen in this center. Mercury-197 was used rather than ^{203}Hg because it has physical characteristics, such as a shorter half-life (2.7 days compared to 47 days), which allow less radiation to be delivered to the patients studied. Also, γ spectrometry permits easy separation of ^{131}I and ^{197}Hg when both renograms are obtained; ^{203}Hg, however, had a similar γ spectrum to ^{131}I. On the basis of the results, both the ^{197}Hg-

Neohydrin renogram and scintiscan were found to reflect glomerular filtration, urine flow rate, degree of tubular secretory activity, and amount of renal tissue in addition to renal blood flow change. Based upon these observations the ^{197}Hg-Neohydrin renogram, properly interpretated, can be the more effective screening agent for the detection of abnormalities of renal function induced by a wide variety of the causes. The ^{197}Hg-Neohydrin renogram represents a more accurate tool than the aortogram or ^{131}I-Hippuran renogram. In rats which had been exposed to a whole-body radiation dose of 430 rad 12 months previously, renal uptake of ^{197}Hg-Neohydrin was slightly increased, whereas in rats given Pb acetate it was markedly decreased. (BBB)

28187 COBALT-60 TELECURIETHERAPY IN THE DEFINITIVE TREATMENT OF CARCINOMA OF THE PROSTATE: A PRELIMINARY REPORT. Frederick W. George, Carter E. Carlton, Jr., Robert F. Dykhuizen, and James R. Dillon (U. S. Naval Hospital, San Diego, Calif.). J. Urol., 93: 102-9(Jan. 1965).

Prevention of complications of radiotherapy and treatment of them when they did occur are described with reference to nine cases, the first reported cases of prostatic cancer to be treated with ^{60}Co γ radiation. Carcinoma of the prostate is considered to be a relatively radiation-resistant tumor because of the poor response to conventional 250-kv therapy. No reports of primary treatment of prostatic carcinoma with ^{60}Co therapy are available. Prior to telecobalt therapy, patients are placed on furadantin, 100 mg 4 times a day, and prednisolone, 5 mg four times a day, which are continued during the first week of therapy to decrease inflammation and edema in the prostate and bladder. This is particularly important in patients with borderline prostatic obstruction, and it appeared to obviate the necessity for transurethral resection during this phase of treatment. The patient is also cautioned to maintain strict hygiene in the affected region. Single anterior and posterior coplanar opposed portals only are used without perineal portals and without cross-fire portals or rotational therapy. Cross-fire and rotational techniques, almost universally employed in the treatment of genital and urinary lesions in this area, are not used and are believed to be responsible for the high incidence of rectal and other complications reported with radical radiotherapy in this area. The most notable complication reported rectal hemorrhage associated with rectal inflammation and necrosis. Both the cross-fire and rotational techniques are based on the small-volume, high-dose concept in radiotherapy which is oncologically and anatomically unsound, and is considered to be the major cause of treatment failure and complications reported in previous attempts to control carcinoma of the prostate with external radiation therapy. With superimposition of the treatment portals used in the cross-fire technique the rectum, instead of being spared, is actually a radiation hot spot; and instead of receiving a lower dose of therapy actually receives more nearly 10,000 R administered in a brief period of time. This seems to explain the sloughs and hemorrhage involving the rectum during such therapy. With coplanar opposed portals, the potential tumor-bearing area from just below the skin surface anteriorly to just below the skin surface posteriorly is brought to a homogeneous radiation dose centered in line on the basis of transverse planigraphy. The rectum receives a homogeneous dose of radiation therapy with no radiation hot spots. No area in the entire radiated volume of tissue is carried above the tolerance dose and therefore the complications of cross-firing techniques are not encountered with this treatment. The radiation is given six days per week to alternate anterior and posterior portals at a dose rate of 200 R in air daily giving about 800 rad per week to the tumor with a source-skin distance of 100 cm using a 5000-C teletherapy apparatus. An important consideration in the prevention of skin complications is the careful separation of the buttocks during treatment with the posterior portal, accomplished by tape applied to the buttocks outside the therapy portal. When this is properly applied the anal and perineal skin area is brought to the surface and the severe proctitis and intergluteal epidermatitis which would otherwise develop is avoided. The total depth dose achieved by this technique varies from 6000 to 7500 rad in seven to 11 weeks. This is individualized depending on the initial tumor size, tumor response, and local and systemic reactions manifested by the patient. Tumor regression was frequently noted within the first 10 days of treatment and was thereafter gradual and prolonged, continuing for several months after the completion of radiotherapy. The patients have all tolerated therapy well on an outpatient basis, and no serious complications occurred. Most patients experienced mild proctitis which was easily controlled with medication. (BBB)

28188 HYPOTHYROIDISM AFTER TREATMENT OF THYROTOXICOSIS WITH RADIOIODINE. Lancet, 1: 637-9 (Mar. 20, 1965).

Late complications of ^{131}I treatment for hyperthyroidism are discussed. The main hazard is hypothyroidism as a late sequel. Follow-up studies have confirmed that between 2 and 5% of those treated with radioiodine become hypothyroid each year. The incidence has continued to increase for at least 15 yr, and there is no sign that a plateau has been reached. Other complications are uncommon. It was once feared that malignant changes might ensure in the gland, but in adults thyroid carcinoma does not seem to be increased by radioiodine therapy. On the other hand, in children irradiation of the thyroid is best avoided. Studies of the blood radiation dosage after ^{131}I therapy suggest that the risk of leukemia is slight. How thyrotoxic patients who have had radioiodine should be managed is also discussed. It is suggested that patients treated with ^{131}I should have periodic routine examination and lab tests, but if this is not possible, it is safer to give thyroxine (0.2 mg daily) for life as soon as the patient is euthyroid. This simple and cheap treatment will prevent hypothyroidism in at least a third of the patients treated with radioiodine. (TCO)

28189 LEUKEMOGENIC EFFECT OF IONIZING-IRRADIATION TREATMENT IN POLYCYTHEMIA. B. Modan (Tel-Hashomer Government Hospital, Israel) and A. Lilienfield. Lancet, 1: 607-8(May 13, 1965).

A reply is made to the criticisms advanced by Osgood (Lancet, 2: 967(1964)) of previous data reported by the present authors (Lancet, 2: 439(1964)) showing a significant incidence of leukemia in patients with polycythemia vera treated with ^{32}P. Contrary to assertions, the median or the mean survival-time of ^{32}P-treated patients was not found to be 13.2 yr. This figure was used to demonstrate the widely prevalent error made when the survivorship of these patients had been computed in previous reports. It was pointed out that the series of cases presented included polycythemia vera patients diagnosed since 1937, whereas ^{32}P became a major therapeutic agent only in the mid 1940's. Patients diagnosed during the earlier period who had had a short survival time did not live long enough to be included in the ^{32}P-treated group, and, therefore, were considered as nonradiation-treated. In this way the ^{32}P-treated group would include a larger proportion of patients with a longer survival-time, thus artificially increasing the median survival time of the group. In the same way, most of the ^{32}P-treated patients were diagnosed during a more recent period, and therefore a smaller proportion of these will have died by the present termination date of the study, compared with those who had received no radiation treatment. The data presented indicated that the dose-response relation was present in all the periods. A life-table analysis of the annual probability of dying from acute leukemia indicates that the frequency of acute leukemia does not decrease with time at risk; actually an increase in risk is suggested. (BBB)

28190 CLINICAL TRIAL OF MODIFIED GAMMA CAMERA FOR THYROID SCANNING. John A. Thomson, James A. Boyle, Edward M. McGirr, and Donald R. G. Tilston (Royal Infirmary and Regional Physics Dept., Glasgow). Lancet, 2: 714-16(Oct. 3, 1964).

The technique of thyroid scanning with a gamma camera was modified by taking a double-exposure photograph of the patient's neck after photographing the thyroid scan. This

improved method localized radioiodine in the thyroid gland very well in 74% of patients, and the photograph showed clearly the relation of the thyroid to other neck structures. Twenty-four to 48 hr after an oral (25-μC) dose of ^{131}I, the patient was placed in position under the gamma camera. When as good a picture as possible (after about two min) was obtained on the fluorescent screen, a photograph was taken by means of a Polaroid camera. The gamma camera was then moved aside, and the Polaroid camera was placed over the same area of the patient's neck as that previously occupied by the gamma camera. A double exposure photograph was then taken. Better pictures in patients with asymmetrical glands than in those with symmetrical glands were obtained. Experience also showed that the technique is applicable to scanning the necks of patients for thyroid remnants after thyroidectomy and is useful in patients with thyroid carcinoma as well as those with thyrotoxicosis and nontoxic goiters. The results of the present trial are better than in a previous study in which only 48% of patients gave a good scan. Moreover, in that study, the tracer dose used was 50 μC against 25 μC in the present trial. The technique of gamma scanning is quick and convenient, the whole process taking about five min. If desired, the display can easily be erased and the scan performed again. Scintiscanning probably is more time-consuming. The present model of the gamma camera can distinguish two point sources 2 cm apart when these are placed at an operating distance of 10 cm from the pinhole. The gamma camera is more expensive than a scintiscanner (£4600 as against £3500). (BBB)

28191 COMBINED RADIATION AND SURGICAL THERAPY FOR CANCER OF THE LARYNX AND LARYNGOPHARYNX. PART II. Joseph L. Goldman, Sidney M. Silverstone, Henry D. Rosin, Robert V. Cheren, and Frederick G. Zak (Mt. Sinai Hospital, New York, N. Y.). Laryngoscope, 74: 1111-34(Aug. 1964).

Histologic changes and complications resulting from radiation treatment of 23 patients are reported. The combined therapy used was a three-phase integrated program comprising first, a course of ^{60}Co teletherapy for a tumor dose of 5500 rad in five weeks; second, a postradiation rest interval of three to six weeks; third, a radical surgical procedure. This dose of radiation was considered within the limits of tolerance of the normal tissues so as not to interfere with subsequent surgery. The γ radiation of ^{60}Co was directed to the entire laryngopharynx, or beyond, to encompass the tumor-bearing structures including the cervical lymph nodes. This was accomplished through parallel opposing lateral cervical fields which often are necessarily large, from 6 × 8 cm to as much as 10 × 12 cm. The tissues encompassed by the beam of radiation were checked by roentgenograms, and if the irradiated volume included the spinal cord, adjustments were made so that the spinal cord itself did not receive a dose in excess of 3500 rad to avoid the risk of radiation myelitis. Radiation therapy was usually well tolerated. The mucosal reactions consisted of congestion and patchy membrane formation. The main complaints were dryness and sometimes loss of taste. The skin showed mild to moderate erythema followed by pigmentation and dry desquamation. The initial radiation reaction subsided in about three weeks, while the late postradiation reactions become surgically significant after six weeks following completion of radiation. The problem of wound healing was a basic concern in combined radiation and surgical therapy. There were 13 complications (eight fistulas, three infections, two flap necroses); however, in every instance a completely healed wound was obtained. The overall average for the postoperative healing period was 27 days–without fistulas 17 days, with fistulas 34 days. Efforts directed to cope with the problem of fistulization included preoperative neomycin mouth washes and bactericidal antibiotics, preoperative cleansing of neck skin with Phisohex, three-layered pharyngeal closure with interrupted sutures. Hemovac suction, controlled expectoration of saliva, nasopharyngeal suction, and use of concentrated oxygen in a tent. The preliminary report of the survival rate of the Stage III patients, treated for advanced laryngeal and laryngopharngeal carcinoma by combined radiation and surgery, showed that of the 23 patients treated, 18 are now living and free from disease 15 to 65 months, and 13 have survived over two yr. Thus the two-year absolute survival is 72%. (BBB)

28192 NOMENCLATURE AND LITERATURE OF RADIOLOGIC DIAGNOSTIC AGENTS. William H. Strain (Univ. of Rochester, N. Y.). Med. Radiography Phot., 40: 3-9 (1964).

The radiologic diagnostic agents discussed are divided into radiopaques and radioisotopes. The radiopaques, or contrast media, increase the absorption of x rays as they pass through the body, whereas the radioisotopes emit characteristic radiations that are detectable by radiologic methods. The contrast media are used particularly for the delineation of natural body cavities, and the radioisotopes, especially for selective accumulation in specific tissues. Both are employed to study the functions or organs. (BBB)

28193 RADIOLOGIC DIAGNOSTIC AGENTS: A COMPILATION. William H. Strain (Univ. of Rochester, N. Y.). Med. Radiography Phot., 40: Suppl., 1-110(1964).

Six reports are presented on the use of various agents in diagnostic radiology. Extensive bibliographies and lists of manufacturers are included. The material is discussed under the following headings: alimentary-tract radiopaques, water-soluble radiopaques, cholecystopaques, viscous and oily radiopaques, and radioisotopic agents. In each presentation there is a summary on progress in the development of the agents, a compilation of the chemistry and formulations of the various preparations, and a tabulation of the known product names used for the agents in various countries. A condensed name of the manufacturer or distributor of each product, where known, is given in the tabulations, and the complete name and address are shown in an appendix of manufacturers. (BBB)

28194 RADIOISOTOPIC AGENTS. Robert H. Greenlaw (Univ. of Kentucky, Lexington) and William H. Strain. Med. Radiography Phot., 40: Suppl., 82-106(1964).

Extensive data on radioisotopes and labeled compounds used in medical diagnosis are presented in a series of tables. Historical aspects of development of these agents are considered and specific isotopes applicable to various diagnóstic problems are discussed. In one table the agents are listed according to application, with designation of each radioisotope, so that all agents developed for a specific use are comparable. In another table the agents are divided into radiochemical groups arranged alphabetically according to radioisotope. This table shows the chemical formula for each radioisotopic agent together with the product or generic names, or the chemical name where the generic name is not known. The agents range from carrier-free sodium iodide-^{131}I to randomly labeled organic preparations. In a third table the agents themselves are arranged alphabetically, and references are given for each agent, the radioisotope is shown, the application to diagnosis is stated, the chemical formula is indicated, and the source of each agent is cited. Standardization of the nomenclature of radioisotope agents by various international organizations is also considered. (BBB)

28195 THE CLINICAL USE OF RADIOISOTOPES. B. G. Ziedses Des Plantes. Ned. Tijdschr. Geneesk., 108: 1982-6(Oct. 17, 1964). (In Dutch)

Diagnostic uses of ^{51}Cr, ^{59}Fe, ^{60}Co, and ^{131}I are reviewed. (BBB)

28196 TREATMENT OF HYPERTHYROIDISM IN CHILDREN: ANALYSIS OF FORTY-FIVE PATIENTS. M. D. Kogut, S. A. Kaplan, P. J. Collipp, T. Tiamsic, and D. Boyle (Univ. of Southern California, Los Angeles). New Engl. J. Med., 272: 217-21(Feb. 4, 1965).

Hypothyroidism and carcinogenesis are examined as possible side-effects in children treated with radioiodine. Of the 45 children, 24 were treated with ^{131}I, 15 with antithyroid medication, and 12 with surgery. The ^{131}I-treated children received a total dose varying from 0.7 to 4.3 mC.

Sixteen patients were followed for two to 14 yr after receiving ^{131}I therapy. Of these, 12 received one dose, which was followed by regression of symptoms. A good clinical response was noted within two months in 14 patients. There were four recurrences: two after seven months; one after one year; and one after three years and nine months. These four were given a second dose. The child who relapsed after one year had another recurrence one year after the second dose and received a third dose of ^{131}I. Hypothyroidism was noted in five of 15 patients (33%) followed for more than two years, total dose in these patients varying from 0.83 to 4.3 mC. In one of the two children who had a recurrence and were retreated seven months after the initial course, a thyroid nodule developed 20 months after the second course. A radioactive scan of the thyroid gland revealed decreased ^{131}I uptake over the left lobe, where the nodule was located, and a histologic study of the nodule removed surgically revealed papillary carcinoma with vascular invasion. No metastases were found. No cases of leukemia have been discovered in this group. It is not possible to incriminate ^{131}I as the cause of cancer in this patient for several reasons. Thyroid carcinoma has been observed in thyrotoxic patients who have not received ^{131}I therapy; second, the thyroid cancer was discovered a relatively short time after the administration of ^{131}I; third, because of the presence of congenital heart disease, numerous x-ray examinations of the chest were made during infancy and childhood. Since most carcinomas of the thyroid gland proliferate slowly, additional years of observation will be necessary before it is known whether the incidence of thyroid cancer in childhood secondary to ^{131}I radiation is greater than that indicated by present evidence. The high incidence of permanent hypothyroidism in patients treated with ^{131}I has previously been stressed and five of the present patients suffered from this complication. Until the delayed effects of ^{131}I on children are well known it appears reasonable to withhold its use for the treatment of hyperthyroidism in this age group. In view of the poor experience with medical therapy and the possible dangers of ^{131}I treatment the procedure now adopted is to submit all patients to subtotal thyroidectomy when the diagnosis is first made. (BBB)

28197 RADIOACTIVE ISOTOPES IN CLINICAL MEDICINE. Solomon Silver (Mt. Sinai Hospital, New York). New Engl. J. Med., 272: 466-72(Mar. 4, 1965).

Use of radioiodine in diagnosis and treatment of thyroid diseases is surveyed, with consideration of the advantages and disadvantages of the various radioisotopes, their physical and biological properties, and hazards attendant to their use. The use of shorter-lived isotopes of iodine and ^{125}I is discussed. Although ^{131}I continues to be the most readily available and the most generally used isotope of iodine for general clinical purposes (since it has a convenient half-life, 8.1 days, so that it can be kept available and clinical studies can be made over days or even weeks), ^{130}I, with a half-life of 12.6 hr, and ^{132}I, with a half-life of 2.33 hr, can be used in special cases. Because of its short life, ^{132}I has advantages when repeated studies at short intervals are to be made or radiation dosage must be kept to an absolute minimum as in children or pregnant women. Also, ^{133}I, with a half-life of 21 hr, is available, as is ^{123}I, with a half-life of 25 min. With a half-life of about 60 days, ^{125}I's most likely application is in labeling compounds for experimental use when long life and low-internal-energy decomposition are important. Localization of ^{131}I within the thyroid gland, ectopic thyroid tissue, thyroid cancer, and metastases is examined. By autoradiography, ^{131}I can also be localized within tissue by placing of thin sections of the tissue in contact with a photographic film or emulsion. With proper technic not only gross but even intracellular distribution of the isotope can be studied. Over 150,000 patients with hyperthyroidism have been treated with ^{131}I since 1946. There is a considerable difference of opinion regarding which patients are especially suitable for this form of therapy. However, therapeutic indications for ^{131}I are being widened rather than being restricted. Therapy depends on the thyroidal localization of the isotope and the resultant destruction of thyroid tissue by the emitted energy. Because this is essentially (90%) in β rays, whose max path in tissue is 2.0 mm and average range is less than 0.5 mm, there is no significant extrathyroidal radiation, and injury to the recurrent laryngeal nerves and parathyroid glands does not occur. Transient exacerbation of the disease is very rare. Radiation sialitis is extremely infrequent, as is radiation thyroiditis. The fear of possible carcinogenesis has caused many clinics to limit the use of ^{131}I to patients over 40 yr of age, but there is a tendency now to lower the age limit, and some groups have abandoned it altogether. It is best not to treat patients below 20 yr of age except in special situations. Pregnancy is an absolute contraindication of ^{131}I therapy because it traverses the placental barrier. In isolated cases in which a patient was not known to be pregnant, no untoward results from ^{131}I were seen in the mother or child. Lactation is also a contraindication, for the ^{131}I enters the mother's milk. If treatment is to be instituted, the child should first be weaned. The first dose, based on the size of the gland and the uptake of the tracer dose, is calculated to deliver about 7000 rad to the diffuse toxic goiter and about 10,000 rad to the toxic nodular goiter. This requires a retained dose of about 80 μC per g in the former and about 120 μC per g in the latter. In the author's series the average number of doses to control the disease was 1.9 for diffuse goiters and 2.3 for nodular goiters, and the average total administered dose was 7.3 and 10.3 mC respectively. Incidence of myxedema after ^{131}I therapy is a serious problem whose incidence varies in different series, but probably averages about 7%. This complication tends to rise with the passage of time and may reach 30% in ten yr. There are no authenticated cases of thyroid carcinoma caused by ^{131}I therapy. Although 20 cases of leukemia have been reported after ^{131}I therapy for hyperthyroidism, careful statistical analysis shows no increase above the expected incidence in the general population. As for genetic damage, there is no reliable information available. (BBB)

28198 STUDY OF THE INTESTINAL ABSORPTION OF VITAMIN B_{12} LABELED WITH Co^{58} IN PATIENTS IRRADIATED IN THE ABDOMENO-PELVIC REGION. L. Dalla Palma and L. Cionini (Universita, Florence). Nuntius Radiol., 30: 931-48(Oct. 1964). (In Italian)

The intestinal absorption of B_{12} vitamin labeled by ^{58}Co was studied in 38 patients submitted to radiotherapy on the abdomen, 30 of which were irradiated on both the lower pelvic and abdominal area and 8 on the upper abdominal region. In the latter, an alteration of the absorption was observed only at the end of the irradiation cycle, after high doses. In patients irradiated on both the lower pelvic and abdominal region, on the contrary, an alteration of the absorption was observed already at half cycle of irradiation in $^3/_4$ of the cases and, at the end of the cycle, an improvement was observed in the majority of the patients, while in the others either an aggravation or a stabilization was remarked. In a group of subjects irradiated and treated by antibiotics, in order to clarify the significance of the intestinal flora, no behavior substantially different from the other cases was observed. Analogously to what was observed for the other substances (triolein, oleic acid, iron, xylose) no change in the absorption closely proportional to the administered dose, was observed. The results obtained are discussed. (auth)

28199 HEMODYNAMIC CHANGES IN PATIENTS WITH HYPERTHYROIDISM AND POLYCYTHEMIA VERA TREATED WITH RADIOACTIVE ISOTOPES. Jan Hasik (Medical Academy, Poznan, Poland). Poznan. Towarz. Przyjaciol Nauk, Wydzial Lekar., Prace Komisji Med. Doswiadczalnej, 28: 103-45(1964). (In Polish)

Hemodynamic studies were carried out on 55 patients with hyperthyroidism prior to treatment, 60 patients with hyperthyroidism following treatment with ^{131}I, 10 patients with ^{131}I-induced hypothyroidism, 25 patients with polycythemia prior to treatment, and 12 such patients after treatment with ^{32}P. For comparison, 12 subjects with primary

hypothyroidism and 40 healthy subjects aged from 20 to 30 were also included in this study, which consisted of the following: (1) Physical analysis of circulation, (2) Assessment of the dynamics of left ventricle contraction, (3) The electrocardiogram (ECG) and ballistocardiogram (BCG). Two correction factors were applied to the physical analysis of circulation in polycythemia patients: (1) a blood viscosity factor of 1.063, and (2) a factor of 20% for the widening of the transverse dia of the aorta. The qualitative appearance of the arterial sphygmogram was found to be of value for following the effect of therapy with radioisotopes. Studies on pulse wave velocity indicated that an increase in pulse wave velocity does not indicate change pathognomonic of atherosclerosis, the deficiency in arterial wall elasticity being rather due to metabolic and neurogenic factors. The ^{131}I therapy of hyperthyroidism prevents circulatory failure by reducing cardiac stroke volume, cardiac output, and heart work. The isometric phase of cardiac contraction is prolonged to upper normal limits after ^{131}I treatment. The shape of the BCG becomes improved and a normalization of time ratios in relation to the ECG is evident. The same holds true for the time duration of particular segments of the BCG tracing. The pulse velocity increases up to normal values. The percentage of patients without pathological ECG findings is increased after ^{131}I treatment. The treatment of polycythemia patients with ^{32}P reduces the overload on the circulatory system by reducing cardiac stroke volume, cardiac output, and heart work to the normal range. The pulse wave velocity and arterial elastic resistance are also decreased after ^{32}P treatment. The isometric phase of left ventricular contraction is shortened. The time duration of some BCG segments previously increased returns to normal range. ECG changes become partially reversed qualitatively and quantitatively. Detailed data are presented in numerous tables. (BBB)

28200 PHYSICAL ASPECTS OF PARTICLE BEAM THERAPY. J. Rotblat (St. Bartholomew's Hospital Medical Coll., London). Proc. Roy. Soc. Med., 58: 159(Mar. 1965).

The advantage of particle beams in radiotherapy arises from properties such as: well-defined range in tissue, little scattering in passage through the body, gradual increase of the specific ionization along range with high peak near the end of the range (Bragg peak); and high LET (linear energy transfer), with the consequent elimination of the disadvantageous difference in radiation sensitivity between oxygenated and hypoxic tissue. The particles that could be used in radiotherapy are: electrons, neutrons, protons, and π mesons. The use of π mesons is based on their property of producing α particles and heavier ions when they are stopped in matter. Electrons have only the first property and even this is not well defined, but nevertheless there are advantages in using electrons in some cases in radiotherapy. The claim for the advantage of neutrons rests entirely on the last property. High-energy protons, deuterons, and α particles have the first three properties, and are particularly useful for radiosurgery. Heavy ion and π-meson beams possess all the advantageous properties enumerated above, and therefore offer the best hope for a major advance in radiotherapy; however, the accelerators necessary to produce such beams in usable intensity are extremely expensive. (BBB)

28201 ELECTRON BEAM THERAPY: PERSONAL EXPERIENCE AND REVIEW OF THE MONTREAUX SYMPOSIUM. A. Zuppinger (Universitat, Bern). Proc. Roy. Soc. Med., 58: 159-60(Mar. 1965).

Data presented at the Symposium on High Energy Electrons (Physical, Biological and Therapeutic Aspects), Montreaux, September 7-11, 1964 are discussed. The physical advantages of using electron therapy in tumors up to a certain depth below the surface diminishes in energies over 15 Mev, but rotation therapy and especially the electronic lens allows these to operate even in higher energies. There appeared to be a better chance of eradication of some tumors with electrons than with photons, and it was possible to influence several tumors which so far have been considered radioresistant. This was the case in mixed tumors of the parotid, synoviomas, fibro-, spindle-, lipo-, myso-, and polymorpho-nuclear cell sarcomas. Adenocarcinoma of the gastrointestinal tract showed a good response but pre-operative irradiation is recommended as the routine technique because of the high sensitivity of the mucous membrane. In 157 cases of preoperative treatment of tumors variously located, a good regression of the tumor and a low rate of operative and postoperative complications were obtained with electron therapy. These clinical experiences showed good results in extensive skin and lip cancers, melanomas, oral cancers, struma maligna, breast cancer, cancer of the cervix in pregnancy, and lung cancer. In hypopharynx and bladder cancer, as well as in brain tumors, the amelioration was doubtful. Electrons have some physical and probably some biological advantages which justify their clinical application. (BBB)

28202 ELECTRON THERAPY AT 8 Mev. Robert Morrison (Hammersmith Hospital, London). Proc. Roy. Soc. Med., 58: 160(Mar. 1965).

Physical properties of the electron beam are described. The beam is emitted from the end of the accelerating tube of the linear accelerator as a pencil of radiation 1 cm in dia. To give a uniform treatment over a reasonable area the beam passes through scattering material made of Au foil, 0.11 mm thick. Whole-body irradiation is given by an open field but for the treatment of localized tumors the beam is defined by a metal collimating cylinder 1 m long. When the full depth of penetration is not required, the energy of the electrons can be reduced by passing the beam through a block of carbon 1.5 cm thick. The central axis depth dose from the beam scattered by the Au foil rises from 90% on the skin surface to 100% at 1.5 cm deep and thereafter there is a steep fall almost to zero at about 4 cm which is the maximum range of the electrons. The 80% dose level falls at 2.5 cm deep which is the maximum depth of effective treatment. Clinical applications are enumerated. This radiation can be used as an alternative to a Ra applicator in the treatment of localized skin tumors, and avoids the radiation hazard associated with the handling of Ra. It is particularly suitable for lesions on the chest wall and skin. Electron therapy in the 2- to 10-Mev energy range can be generated by a linear accelerator which is modified to allow the electron beam to be extracted. It is an advantage for the electron radiation to emerge from the machine from the same port as the x rays. (TCO)

28203 OXYGEN ENHANCEMENT RATIOS AND DEPTH DOSES AS OPPOSING FACTORS IN FAST NEUTRON THERAPY. J. F. Fowler (Postgraduate Medical School, London). Proc. Roy. Soc. Med., 58: 160-1(Mar. 1965).

X rays and electrons, as lightly ionizing radiations, are less effective in killing anoxic cells than well-oxygenated cells by a dose reduction factor of 2.5 to 3. This is a major disadvantage in radiotherapy, since even small tumors have many anoxic foci. Fast neutrons interact with tissue to produce densely ionizing tracks of protons and nuclei of C, N, and O. The difference between the killing of anoxic or oxygenated cells is smaller, being only a dose factor of 1.3-1.9, depending on neutron energy, instead of 2.5-3. This means that fast neutrons have a disadvantage of only ~1.6. In terms of so-called anoxic gain factor, G, for neutrons compared with x rays, in this example it would be G = 3/1.6 = 1.7. This means that, for equal damage to oxygenated cells, the damage to anoxic cells is as if the x-ray dose had been increased by the factor 1.7. There is a compromise between low-energy fast neutrons (1 or 2 Mev) having poor penetration but good anoxic gain factors and higher energy fast neutrons (10 to 14 Mev) with better penetration but lower anoxic gain factors. If the depth dose (at a given depth) is multiplied by the anoxic gain factor G, an anoxic corrected depth dose is obtained for each neutron energy. (TCO)

28204 RADIATION RESPONSE OF DIFFUSE PLEURAL MESOTHELIOMA: A CASE REPORT. J. M. Vaeth and

T. R. Purcell (Univ. of California, San Francisco). Radiol. Clin., 33: 319-27(1964).

Radiosensitivity of pleural mesothelioma is discussed with reference to previously reported cases and one new patient. A compilation of 51 reported cases of diffuse pleural mesothelioma shows that survival from the time of diagnosis averaged about 10 months, ranging from less than 1 month to 6 yr. Survival in 8 of these patients exceeded 12 months. Of the 8 who survived more than 12 months, 6 had received radiation therapy and the patient surviving longest, 6 yr, had received intracavitary ^{198}Au. Diffuse pleural mesothelioma, in a patient whose history is described in detail, proved to be radioresponsive. The patient was treated by external x-ray therapy to the involved regions of the chest to a dose of 6000 R over an extended period. There was demonstrable regression of the tumor and relief of pain. The patient survived 3 yr, but died of the disease. As demonstrated objectively by diagnostic roentgenograms and subjectively by clinical improvement, a definite radiation response was obtained in this patient. With the extended form of treatment, a response was first observed at about the 5000-R dose level. Generally, the same result was obtained in the other treated areas. In the patient described, three different chemotherapeutic agents resulted in little or no effect. It is concluded that response to radiation therapy in a single case of pleural mesothelioma cannot serve as a standard of treatment for other patients with the same disease, and that radiation to a reasonable dose level can significantly influence the tumor without appreciable morbidity. (BBB)

28205 RENAL RADIOISOTOPE SCINTISCANNING. James L. Quinn, III (Northwestern Univ. Medical School, Chicago) and C. Douglas Maynard. Radiol. Clin. N. Am., 3: 65-74(Apr. 1965).

Although ^{131}I-orthoiodohippuric acid has been used as a scanning radiopharmaceutical in renal diagnosis, because of its rapid excretion by tubular secretion and glomerular filtration, a marked change occurs in the count rate over the kidneys during the course of the scanning period. An adequate scan cannot be obtained unless there is some blockage to the urinary outflow tract. At present, ^{197}Hg- or ^{203}Hg-chlormerodrin is the best radiopharmaceutical for renal scanning. The radionuclide ^{203}Hg has a physical half-life of 45.4 days and a γ photon peak of 279 kev, while ^{197}Hg has a physical half-life of 65 hr and a spectrum of scanning photons ranging from 68 to 77.8 kev. The dose necessary for diagnostic renal scans is 100 μC for the ^{203}Hg compound and 125 to 150 μC for the ^{197}Hg compound in an adult male. A narrow spectrometer window should be used with both to avoid detection of scattered photons of reduced energy. The window recommended with ^{203}Hg is 254 to 304 kev and for ^{197}Hg, 65 to 90 kev. The asymmetrical window used in ^{197}Hg scans results in a sharper image. A standard 19-hole lead focusing collimator was used with a scanning speed of 30 to 35 cm/min, depending on the count rate obtained over the kidneys. Scans were performed about one hr after intravenous administration of the radiopharmaceutical and required 45 min to complete. The radiation dose which the kidney receives from the diagnostic dose of radiochlormerodrin is still uncertain. Determination of the dose is difficult because different age groups retain varying amounts of the chlormerodrin, older persons retaining more than the younger ones. It is further complicated by the fact that the cortical-to-medullary activity ratio is ~10:1. It is estimated that renal irradiation from 100 μC of ^{203}Hg is 20 to 30 rad per kidney and from ^{197}Hg, 3 to 4 rad per kidney. It is prudent to restrict the use of ^{203}Hg in renal scanning to older patients. Some typical scans are illustrated and their interpretation discussed. (BBB)

28206 PRIMARY HEMANGIOENDOTHELIOMA OF THE HEART: REPORT OF A CASE TREATED WITH IRRADIATION AND CYCLOPHOSPHAMIDE. F. John Allaire, Clark A. Grimm, Lloyd M. Taylor, and John P. Pfaff, Jr. (Great Fall Clinic, Mont.). Rocky Mt. Med. J., 61: 34-7 (Sept. 1964).

Cobalt-60 irradiation of a primary malignant hemangioendothelioma of the heart originating in the right atrium in a 24-yr-old male is described. It is believed that this is the first reported case of primary cardiac tumor in which irradiation therapy resulted in palliation. Cyclophosphamide was used without benefit. Cobalt-60 irradiation was given in an attempt to deliver a cancericidal dose to the tumor, without exceeding the tolerance of the thoracic spinal cord. A large anterior chest wall portal was alternated with two posterior fields, angled obliquely from either side of the spine. A calculated tumor dose of 200 R/day was delivered; during a six-week period, 5630 R was given to the mid portion of the tumor. The cardiac silhouette then returned to near normal. Despite development of widespread metastatic disease later, clinical evidence of recurrence of tumor involvement of the heart did not again appear. (BBB)

28207 EXPERIENCE WITH THE MANAGEMENT OF MALIGNANT LYMPHOMA IN DOGS. G. Moldovanu, M. Friedman, and D. G. Miller (Sloan-Kettering Inst. for Cancer Research, New York). Sangre, 9: 253-62(1964).

The effects of irradiation or splenectomy in 25 dogs with lymphoma are described. Radiation therapy was given in four equally fractionated doses, totalling 200 or 300 R total-body irradiation. X rays of 250 kv at 25 or 45 R/min dose rate on each side were used. As criteria of the effect of treatment, cervical, suprascapular, and popliteal lymph nodes were measured weekly. Bone marrow aspiration was done and blood counts were checked weekly. A few dogs were treated either with steroids or radiation therapy and another group underwent splenectomy. The dogs treated with prednisone at 5 to 15 mg/kg over 5 to 7 days had survival times of 43 and 35 days. The radiation group showed improvement at completion of treatment. Lymph nodes decreased in size, clinical condition improved, and no gastrointestinal disorder was noticed. Leucocytosis decreased by 50 to 75% of the initial value, and circulating tumor cells decreased considerably in all irradiated dogs. However, the remission did not last more than 3 weeks, and the recurrence appeared even more malignant with enlarged lymph nodes, leucocytosis, and increased number of circulating tumor cells. Nine dogs with malignant lymphomas were splenectomized; this proved to be transiently beneficial. Prolongation of life obtained by radiation therapy or by steroids was not impressive; average survival time between this group and the splenectomized group were 45 days vs 76 days, which was not significant. (BBB)

28208 OBSERVATIONS ON COLLAGEN IN HUMAN SKIN AFFECTED BY RADIODERMATITIS. F. Mussinelli and Isabella Mussini (Universita, Milan). Sperimentale, 114: 176-91(June-Aug. 1964). (In Italian)

Biopsies of skin were obtained from normal and dermatitis-affected regions from nine patients who had developed skin lesions as a result of radiotherapy for tumors (from Ra in one case and from x rays in the other eight). The skin was examined histologically and also for various collagen fractions by the method of Jackson (Biochem. J., 65: 277(1957)). Microscopic examination showed various stages of radiodermatitis, from edematous, hypercellular connective tissue to compact, massive hyalinization. Other cases showed necrotic zones with teleangectasia and degenerative changes in muscle and connective tissue. Collagen was fractionated and determined as hydroxyproline. Total collagen was found to be significantly lowered in all cases (mean, 36%; range, 11 to 64%). A different picture emerged from an examination of the collagen fractions. Fraction IV (insoluble collagen), and fraction III (collagen soluble in 0.2M citric acid buffer pH 3.5) were diminished; on the contrary, fractions I and II (collagen soluble in 0.2M NaCl pH 7.4) were considerably increased with respect to controls. The mean per cent values of the observed differences were as follows: fraction I, +43; fraction II, +25; fraction III, −51; fraction IV, −36%. The decrease of insoluble collagen, which represented about 99% of total collagen, agrees with the atrophic changes that invariably accompanies chronic radiation dermatitis. However, no

correlation was found between the histological aspect of the affected dermis and its collagen content. The pattern of collagen fractions in diseased skin was tentatively interpreted as due to an inhibition of the aggregation of tropocollagen to form procollagen and fibrous collagen. As possible mechanisms for the alteration in collagen in chronic radiodermatitis, previous evidence suggests that the keloid formation as a result of irradiation may result from formation of an abnormal peptide which affects tropocollagen. Also, the possible mutation of connective tissue cells forming collagen, thus producing an abnormal protein, cannot be excluded. (BBB)

28209 IRRADIATION COMPLICATIONS IN THE TREATMENT OF BRONCHIAL CANCER: THE COBALT THERAPEUTIC LUNG. David Uzzan. Vie Med., 44: 747-64(May 1963). (In French)

For several years, the use of telecobalt-60 or the betatron has replaced conventional radiotherapy in the treatment of bronchopulmonary cancer. As a result, extrapulmonary complications became rare. Local erythemas were not a skin hazard and did not require interruption of treatment. Patients with hemoptysis received irradiation without complications. There was also a modification of the pulmonary complications. Cobalt-60 therapy did not appear to have a more adverse effect on the pleura than other forms of treatment: some cells became sclerotic and the bronchioles developed hyperplasic epithelium. These were typical cellular reactions to irradiation. Certain tumors, when treated by telecobalt, became partially ulcerated and gangrenous. It was difficult to determine if such a reaction was directly attributable to the irradiation because ulceration and necrosis also occurred spontaneously. Several patients developed large abcesses or necroses, either in healthy parenchyma in the irradiation zone, or in parenchyma altered by the tumor but distant from it. These appeared six months to five years after irradiation and four of the five patients died. The stereotyped aspect of the radiolesions, their identical evolution, and their increased numbers left no doubt of a causal relation with ^{60}Co γ irradiation. (BBB)

28210 COMPARATIVE STUDIES OF THE EFFERENT URETER IN CERVICAL CARCINOMAS OF GROUP III AFTER IRRADIATION WITH ULTRAHARD AND CONVENTIONAL X RAYS. F. Oberheuser (Universitat, Hamburg). Zentr. Gynaekol., 84: 705-10(May 12, 1962). (In German)

A standardized combination of irradiation with implanted Ra and either 15.5-Mev betatron irradiation or x irradiation was used for treatment of cervical carcinoma. The Ra dosage ranged from 4000 to 5000 mg-hr when given with the ultrahard irradiation, which was administered in 22 sessions of 200 R each. When given with conventional, 200-kv x ray, administered in 14 sessions of 125 R each, the Ra dosage was 4000 mg-hr. A total of 25 patients received the Ra and ultrahard irradiation, and 57 were treated with Ra and conventional x ray. They were examined for changes in the intravenous urogram at periods ranging from 1 to 4½ yr later. Of the patients treated with conventional x ray, 20 showed symptoms of hydronephrosis, hydroureter, or ureteral inflammation, either unilaterally or bilaterally. Only 2 instances of these symptoms were observed in the patients treated with 15.5-Mev irradiation. Almost 75% of these complications were observed in patients who had been irradiated not more than 2 yr previously, but probably the ratio of appearance of injuries between the two groups would not vary even if observations were continued for many more yr. The 5-yr survival rates were slightly more favorable in the group treated with ultrahard irradiation, and there were many fewer postirradiation urological complications. (BBB)

28211 CONCEPTS OF RADIATION PROTECTION IN A DIAGNOSTIC X-RAY FACILITY. A PROGRAMED INTRODUCTION. George R. Meckstroth and S. Thomas Elder. New Orleans, Programed Education Development Group, Inc., 1964. 46p.

Programmed instruction, or material which is organized and presented in small, logical, orderly steps, is introduced as a relatively new approach in the improvement of teaching methods in radiology. To meet a need for the immediate training of both medical students and residents, this program was written and tested. The program gives an introduction to maximum permissible dose concepts and discusses the general factors that must be considered in order to minimize radiation hazards and ensure radiation protection in a diagnostic x-ray facility. The program is oriented to the radiologist and brings out the concept of workload, use factor, and occupancy factor with examples of actual determinations of primary barrier thickness. Specific instructions for the safety of the operator and for the x-ray unit are also presented. The programmed instruction material consists of: (1) a set of directions to the user; (2) a list of 154 questions regarding radioprotection practices; (3) the correct answers to these questions; (4) four tables and figures demonstrating principles of radioprotection; (5) a glossary of terms with their definitions relating to x-ray diagnostic methods; and (6) a list of pertinent references; and (7) a brief multiple-choice quiz of radioprotection factors. An attached guide permits the user to compare the correct answers with the 154 questions in the second part. (BBB)

28212 PROGRESS IN RADIATION THERAPY. VOLUME III. Franz Buschke, ed. New York, Grune and Stratton, 1965. 246p.

Progress in radiotherapy, which was made possible by better control of the factors that determine the radiation tolerance of tissues under the conditions of clinical therapy, is discussed. Contributing to the understanding of tissue tolerance is a paper on myelitis induced by radiotherapy. Techniques are presented in: experience with high energy electron beam therapy; the use of the grid in supervoltage therapy; and digital computers in radiation therapy. Clinical aspects considered are: radiation therapy in relation to malignant tumors of the temporal bone; radiotherapy of mammary cancer; radiation therapy in childhood; lymphoma in children; the planning of clinical investigative programs in radiotherapy; and statistical evaluation of the results of treatment of cancer. Educational programs in radiotherapy are discussed in: the teaching of radiation therapy to medical students in America and an ideal education for radiation therapists. (H.G.D.)

CHEMISTRY

General

Refer also to abstracts 28926, 29468, and 29751.

28213 (CEND-529) INVESTIGATION OF CATALYTIC RECOMBINATION OF RADIOLYTIC OXYGEN AND HYDROGEN. Final Report. C. Thomas Sawyer and F. M. Stern (Combustion Engineering, Inc., Windsor, Conn. Nuclear Div.). Mar. 1, 1965. Work Performed under United States-Euratom Joint Research and Development Program. Contract AT(40-1)-3151. 183p. (EURAEC-1385). Dep. (mn); $5.00(cy), 4(mn) CFSTI.

An experimental investigation was conducted on the feasibility of reducing the radiolytic H and O content of boiling reactor steam by catalytic recombination. The efficiencies of nine commercial catalysts of the platinized-metal and platinized alumina type were determined under various temperatures, catalyst bed volumes, and steam flows with 25-30 ppm O and 5% excess H. An equation was derived which describes the gas concentration reduction vs bed depth relationship for most of the catalysts. Corrosion tests using NaCl in steam were also conducted; the results showed that 2-4 ppm NaCl would poison the catalysts within a week, and that the use of a recombiner would reduce corrosion. (D.L.C.)

28214 (ORNL-3739) TRANSURANIUM QUARTERLY PROGRESS REPORT FOR PERIOD ENDING AUGUST 31, 1964. W. D. Burch, comp. (Oak Ridge National Lab., Tenn.). May 1965. Contract W-7405-eng-26. 79p. Dep.; $3.00(cy), 2(mn) CFSTI.

The Transuranium program is directed toward the production of sizeable quantities of the heavy actinide elements for research work. The anion exchange behavior of the transcurium elements with ethylenediaminetetraacetic acid (EDTA) was investigated in an effort to develop a new separation system for the heavy actinide elements. All equipment was installed in the Cm Recovery Facility, and cold runs were begun. Failure of the Homalite (plastic) mixer-settlers by chemical attack necessitated the replacement of these units with models made of Zircaloy-2. Experimental studies of equipment and procedures for the TRU processing cells were continued. Process development work was completed for the various steps in the remote fabrication and inspection of target elements for the High Flux Isotope Reactor. The construction of the Transuranium Processing Plant is 75% complete, with completion date in April of 1965. Attempts to minimize H-pickup by Ta under Al dissolution conditions by coupling Pt to the Ta were unsuccessful. All-Zircaloy dissolvers are the best choice, however, they are also susceptible to H-pickup at boiling temperatures. A technique for determining Li concentrations based on the use of cationic-specific electrodes which develop a potential directly proportional to Li concentration was investigated. (J.R.D.)

28215 (RFP-531) COMPATIBILITY STUDIES OF ANION EXCHANGE RESINS. PART I. THE COMPATIBILITY OF DOWEX 1 × 4 NITRATE FORM ANION RESIN WITH NITRIC ACID AND OXIDES OF NITROGEN. G. F. Molen (Rocky Flats Div., Dow Chemical Co., Golden, Colo.). May 17, 1965. Contract AT(29-1)-1106. 16p. Dep.; $1.00(cy), 1(mn) CFSTI.

The compatibility of Dowex 1 × 4 nitrate form anion exchange resin with nitric acid, and the compatibility of several types of plastic tubing with nitric acid were investigated. Ignition properties of resin extract, treated resin, and mixtures of tubing extract with either resin extract or treated resin were also investigated. (auth)

28216 THIN-LAYER CHROMATOGRAPHY SAMPLE COLLECTOR (Engineering Materials). (Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.). 4 drawings. (CAPE-1195)

Drawings (4) are presented for the sample collector, which consists of a turntable with a stepped rotating mechanism. It is used with a Thin-Layer Chromatography Scraper. The $\frac{3}{8}$-in. Al turntable is $7\frac{3}{4}$-in. dia and is mounted on a $\frac{1}{8}$-in. thick, $8\frac{1}{2}$-in. dia Al sheet. As the 25 counting vials on the turntable are moved in steps under the scraper blade, they are filled with measured samples from the chromatographic plates. (For details, see TID-4100.) (D.L.C.)

Analytical Procedures

Refer also to abstracts 28717, 28972, 29228, and 29318.

28217 (AD-608074) DETERMINATION OF TRACE AMOUNTS OF MOLYBDENUM AND NIOBIUM IN TUNGSTEN USING A SMALL ANION EXCHANGE COLUMN. Ken F. Sugawara (Air Force Materials Lab., Wright-Patterson AFB, Ohio). Aug. 1964. 16p. (ML-TDR-64-268). $1.00(CFSTI).

A procedure is reported for the determination of trace amounts of molybdenum and niobium in tungsten using a comparatively small column. Tungsten, the matrix material, passes through the column while the impurities molybdenum and niobium are adsorbed by the anion exchange resin. Molybdenum and niobium are then selectively eluted from the resin column and determined spectrophotometrically. (auth)

28218 (AD-608438) RESEARCH AND DEVELOPMENT OF AN AUTOMATIC BERYLLIUM AND BORON MONITOR. Phase I Final Report. R. S. Braman (Armour Research Foundation, Chicago, Ill.). June 8, 1962. Contract AF04 (611)-7543. 89p. (ARF-3203-3). $3.00(CFSTI).

The design, construction, and final testing of a prototype borane monitor were completed. Detection of boranes in air is based upon the flame emission of boron in a hydrogen–air flame. Sensitivity is in the 50-ppb range. The prototype has ranges of 0 to 2, 0 to 13, and 0 to 60 ppm. Ammonia and hydrazine interfere to the extent that 250 and 360 parts of these, respectively, produce the same effect as 1 part of pentaborane. The borane monitor is portable and is capable of independent operation for approximately 9 hr. The design, construction, and final testing of a prototype beryllium monitor were completed. Detection is based upon the reaction of beryllium with high-energy alpha particles. Beryllium is deposited onto the surface of a filter tape which passes through a detection chamber. Counting rate data from the $^{9}Be(\alpha, n\gamma)^{12}C$ reaction are used in two alarm circuits which are activated at two beryllium concentrations. The instrument is capable of sensing 0.25 to 0.5 micrograms of beryllium. It is line-operated. (auth)

28219 (AERE-AM-102) THE DETERMINATION OF LEAD 210 AND POLONIUM 210 IN AIR FILTERS. G. S. Spicer (Research Group, United Kingdom Atomic Energy Authority, Woolwich Outstation (England)). Feb. 1965. 13p. Dep.; $0.50(BIS); 2s. 6d. (HMSO).

The filter material is wet-oxidized by nitric and sulfuric acids in the presence of lead and bismuth carriers and ^{208}Po tracer. The oxidation is completed by perchloric acid in the presence of H_2SO_4. The residue is transferred to Pt, and HF is added to attack siliceous matter on which the ^{210}Po is strongly adsorbed. After precipitation of impurities, the Po is deposited by electrochemical replacement of the silver and the source thus prepared is alpha counted in conjunction with a pulse-height analyzer to determine the amount of ^{210}Po by comparison with the ^{208}Po tracer added. The lead is purified by extraction as dithizonate into chloroform and back-extracted into HNO_3 and then counted. (P.C.H.)

28220 (BNWL-12) CHROMATOGRAPHIC ANALYSIS OF HELIUM CONTAINING TRACE IMPURITIES. D. W.

Shannon (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Nov. 1964. Contract AT(45-1)-1830. 18p. Dep.; $1.00(cy), 1(mn) CFSTI.

A gas chromatograph was developed that has a lower detection limit of below 1 ppm for hydrogen, oxygen, nitrogen, methane, carbon monoxide, and carbon dioxide. The instrument can detect neon, argon, krypton, and xenon; argon and oxygen interfere with each other. This chromatograph uses a tritium source ionization detector. When used with ultrapure helium carrier gas, this device functions as an extremely sensitive "helium" detector using the metastable helium atoms to increase response at low ppm levels. Construction and operating details are discussed and a modification is shown that permits total impurity analysis of helium with sensitivities below 1 ppm. (auth)

28221 (EUR-2236.n) ANALYSE VAN POLYFENYLMENGSELS MET DUNNELAAGCHROMATOGRAFIE. (Analysis of Polyphenyl Mixtures by Means of Thin-Layer Chromatography). F. J. Ritter (Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Delft. Centraal Laboratorium). Apr. 1965. 22p. Dep.(mn).

Thin-layer chromatography over Benton 38/Celite (1:1) offers interesting new possibilities for the separation of polyphenyl mixtures. Certain polyphenyl mixtures can be satisfactorily separated by preparative thin-layer chromatography over aluminum oxide. Chromatography over horizontal aluminum oxide columns in cellophane tubes is more laborious and gives less satisfactory separation. For "synthetic mixtures" an adequate method is the quantitative estimation of terphenyls whereby these substances are extracted jointly and determined by spectrophotometry. In the case of practical mixtures, however, the components must be extracted individually. The results of such an analysis are in good agreement with those of gas chromatography. The absolute standard deviations for the ortho-, meta- and para-terphenyl contents were 0.2, 0.8, and 0.2% respectively. For the total terphenyl content, and thus also for the "indirect high-boiler determination," the standard deviation was 0.6%. A "direct high-boiler determination," based on the spectrum of the extracted high-boilers would in principle seem possible, at least if it is confined to radiolyzed OM-2 mixtures. The high-boilers in practical mixtures can be separated from the other components by means of counter-current distribution. This could serve as a basis for direct gravimetric high-boiler determination. (auth)

28222 (IDO-14642) PROPOSED DETERMINATION OF NUCLEAR FUEL BURNUP BASED ON THE RATIO OF TWO STABLE FISSION PRODUCTS OF THE SAME ELEMENT. William J. Maeck (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.). Apr. 1965. Contract AT(10-1)-205. 47p. Dep.; $2.00(cy), 2(mn) CFSTI.

A new method is proposed for the determination of nuclear fuel burnup based on the ratio of selected pairs of two fission product nuclides of the same element. The ratios $^{83}Kr/^{84}Kr$, $^{131}Xe/^{132}Xe$, and $^{143}Nd/^{144}Nd$, which change with irradiation are useful as fission monitors. With this technique, many problems associated with the conventional fission product analysis for burnup are eliminated. (auth)

28223 (NP-14973) ANALYSE NON DESTRUCTIVE D'ELEMENTS DE COMBUSTIBLE IRRADIES. RAPPORT FINAL. (Nondestructive Analysis of Irradiated Elements. Final Progress Report). J. Bai and F. Motte (International Atomic Energy Agency, Vienna (Austria)). Dec. 22, 1960. 14p. Dep.(mn).

A quality control test was made on the counting device by analysis of delayed neutrons emitted by ^{235}U and ^{239}Pu. A tube of enriched uranium and a sample of PuO_2 were the neutron sources. Control of the composition of two homogeneous mixtures of ^{239}Pu and ^{235}U is described. The tests made are discussed, and the mathematical formulation for the standarization of the measurement system and the analysis of the homogeneous mixtures are reported. The selectivity of the method was analyzed on the basis of integrated power. (J.S.R.)

28224 (SGAE-CH-13/1964) AKTIVIERUNGSANALYTISCHE BESTIMMUNG DER VERUNREINIGUNGEN IN ALUMINIUM. (Activation Analytical Determination of the Impurities in Aluminum). W. Kiesl, H. Sorantin, and H. Bildstein (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf). 1964. 16p. Dep.(mn).

A review of the literature on the activation analytical determination of impurities in aluminum is given. An analytical process is described that was perfected at the Seibersdorf Reactor Center. It can be used for the quantitative detection of the elements Dy, Ga, V, Ni, Mn, Cu, Sb, Zn, Sc, Hf, Cr, Co, Fe, Sn, and In. (tr-auth)

28225 (SGAE-PH-11/1964) ABBRANDBESTIMMUNG VON KERNBRENNSTOFFEN MIT HILFE MASSENSPEKTROMETRISCHER METHODEN. (Burn-Up Determination of Nuclear Fuels Using the Mass Spectrometric Methods). F. P. Viehboeck (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Physik-Institut). 1964. 20p. Dep.(mn).

The mass spectrometric method for the determination of the burn-up of nuclear fuels using uranium isotopic analysis was approximately described. (J.S.R.)

28226 (TID-7022(Vol.I)(Bk.3)) ANALYTICAL CHEMISTRY MANUAL OF THE FEED MATERIALS PRODUCTION CENTER. SAMPLES FROM THE SAMPLING PLANT: ALLOY SCRAP (MOLYBDENUM) (627) THROUGH CANADIAN-CAVENDISH CONCENTRATE. (National Lead Co. of Ohio, Cincinnati). Dec. 1964. Contract AT(30-1)-1156. 339p. Dep.; $3.50(cy), 6(mn) CFSTI.

Modifications of general wet-chemical methods are given for specific sample types beginning with "A," "B," and "C." (D.L.C.)

28227 (TID-7022(Vol.I)(Bk.5)) ANALYTICAL CHEMISTRY MANUAL OF THE FEED MATERIALS PRODUCTION CENTER. SAMPLES FROM THE SAMPLING PLANT: CANADIAN-RAYROCK (746) CONCENTRATE THROUGH I. N. X. SUMP LIQUOR. (National Lead Co. of Ohio, Cincinnati). Dec. 1964. Contract AT(30-1)-1156. 364p. Dep.; $3.75(cy), 6(mn) CFSTI.

Modifications of general wet-chemical methods are presented for sample types extending from Canadian concentrate (Rayrock) to I. N. X. sump liquor. (D.L.C.)

28228 (NP-tr-1231) CHROMATOGRAPHIC DETERMINATION OF TRACE QUANTITIES OF WATER VAPOUR IN A GASEOUS ATMOSPHERE. R. Aubeau, L. Champeix, and J. Reiss. Translated by J. M. Jacobs (Atomic Energy Research Establishment, Harwell, Eng.), from J. Chromatog., 16: 7-21(1964). 29p. Dep.(mn); $2.60(fs), $1.07(mf) JCL.

The determination of the content of water vapor in a gas by gas chromatography was investigated by two different methods, namely, with a conversion tube and an adsorption column (indirect method), or with a single partition column (direct method). In the indirect method, the water is first converted into acetylene or into hydrogen and these gases are then separated from the other gases present by means of a silica gel column and a molecular sieve column, respectively. However, owing to the poor reproducibility obtained by this method, the quantitative determination is lacking in precision and may even be inaccurate. In the direct method, the water vapor is separated from the other gases present by means of polyethylene glycol 1500. The tailing of the peak, due to adsorption on most of the usual supports, is considerably reduced when powdered teflon is used as the support for the stationary phase. By this means, with a sample of a few cm^3, it is possible to determine amounts of 100 vpm (volumes per million) or more of water vapor in a gas. By preliminary concentration on a precolumn of the same kind as the partition column, a sensitivity of 1 vpm, or even less, can be attained. The direct method, with or without a system of preliminary concentration, gives a precision of the order of approximately 5 to 8%, which is amply sufficient for most purposes. (auth)

28229 ANALYSIS OF PETROLEUM PRODUCTS BY ABSORPTION OF RADIOACTIVE RADIATIONS. III.

DETERMINATION OF HYDROGEN CONTENT BY COUNTING THE IMPULSES DUE TO ABSORPTION OF β-RADIATION. T. Baliant (Hungarian Petroleum and Natural Gas Research Inst., Veszprem). Acta Chim. Acad. Sci. Hung., 41: 341-53(1964).

A modified method of H determination is described, which is based on absorption of β radiation. The apparatus consists of a radiation source of ^{90}Sr, a cuvette suitable for the sample to be tested, and a methane-flow counter for the measurement of radiation intensity, together with a scaler. The technique involves the measurement of the period for a constant impulse count of samples of a constant surface density. Using the apparatus and technique described, it is possible to determine content of hydrogen with an error of ±0.08% by weight. However, from the results of measurements with pure hydrocarbons it was found that methodical errors interfere with the measurements. Consequently, the method possesses limited suitability for some samples. The 10-mC ^{90}Sr radiation source was inserted into the threaded bore of a polymethacrylate block. From this, the radiation passed through the sample located in the measuring cell and arrived in the methane-counter through a bore of 5-mm dia and 4-cm length. The measuring cell was a brass cylinder with a machined cylindrical hole of 30-mm dia and 12-mm depth for the sample. A mica sheet of 16-mm dia served as window for the measuring cell. (BBB)

28230 ANALYSIS OF PETROLEUM PRODUCTS BY ABSORPTION OF RADIOACTIVE RADIATIONS. IV. CONTRIBUTIONS TO THE DETERMINATION OF ELEMENTARY COMPOSITION BY MEASURING THE ABSORPTION OF ^{55}Fe X-RAYS. T. Balint (Hungarian Petroleum and Natural Gas Research Inst., Veszprem). Acta Chim. Acad. Sci. Hung., 41: 355-64(1964).

The use of ^{55}Fe as radiation source offers over ^{3}H the advantage that, owing to the practically monochromatic radiation of ^{55}Fe, the mass absorption coefficient is a constant value. The accuracy of analyses carried out by measurement of the absorption of the radiation of ^{55}Fe was examined by applying the principles of differential photometry. Owing to the relatively low specific ionization of the radiation of ^{55}Fe, radiation intensity was measured by impulse counting in one of two ways: (a) either the time for a given impulse count, or (b) the impulse count for a given time is measured. The cuvette thickness was chosen to minimize the background radiation. The layer thickness was selected to obtain optimum radiation intensities of from 100 to 10 impulses/sec while the minimum value of background radiation varies from 0.2 to 0.3 impulse/sec (provided the radiation source does not contain any contaminants emitting hard radiation). From the results of analyses, it was found that the determination of the content of nitrogen and oxygen in petroleum products is impossible using the principle of the absorption of ^{55}Fe radiation because heteroatoms of higher atomic number, such as sulfur, markedly interfere with the measurement. Yet the method is suitable for use in exceptional cases; e.g., the oxygen content of oxidized paraffin oil samples was determined on the basis of the measurement of the absorption of ^{55}Fe radiation. Minute amounts of sulfur were present in the basic paraffin oil, and this sulfur content remained practically unchanged during the oxidation process. As the direct determination of oxygen is rather cumbersome and lengthy (requiring 2 to 3 hr), the time requirement of the radiation absorption method (10 min) shows the usefulness of this means of oxygen determination though its applicability is limited. (BBB)

28231 A NEW METHOD OF RADIOACTIVATION ANALYSIS BASED ON THE QUANTITATIVE ISOTOPE DILUTION PRINCIPLE. Nobuo Suzuki (Tohoku Univ., Sendai) and Kiyoshi Kudo. Anal. Chim. Acta, 32: 456-64 (May 1965).

A quantitative isotope dilution method is proposed, which allows the errors due to flux fluctuation and self-shielding, normal to ordinary radioactivation analysis, to be avoided. Three different methods are discussed. The most satisfactory method from a theoretical viewpoint involves division of the irradiated sample into two parts; in one part, an amount m is extracted and the radioactivity a is measured. An amount of carrier M is added to the other part, an amount m is again extracted and its radioactivity a′ is measured. The unknown amount M_x is then calculated from $(a/a') - I = M/M_x$. A method for the determination of traces of copper and silver in tin and zinc based on this principle is described. (auth)

28232 THE DETERMINATION OF CESIUM-137 IN HERBAGE AND SOIL. H. D. Vandervell and A. Morgan (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Analyst, 90: 283-9(May 1965).

A method is described for determining cesium-137 in samples of herbage and soil. The sample, with added cesium carrier, is treated either by wet ashing with nitric and perchloric acids (herbage) or by fusion with alkali (soil). The resulting solution is acidified and passed through a column containing a mixture of ammonium dodecamolybdophosphate and asbestos. Cesium is retained on the column, together with some potassium, which is separated by selective elution. Finally, the ammonium dodecamolybdophosphate is dissolved and the cesium precipitated as the chloroplatinate, which is mounted and its β radiation counted. (auth)

28233 SPECTROPHOTOMETRIC DETERMINATION OF BERYLLIUM WITH BERYLLON III. P. Pakalns and W. W. Flynn (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). Analyst, 90: 300-3(May 1965).

A detailed study of Beryllon III for the determination of Be, showed that in the presence of triethanolamine and EDTA as masking agents it is superior to Beryllon II and Chrome azurol S. The beryllium-Beryllon III complex exhibits a broad absorption peak with a maximum at 526 mμ, when measured against a reagent blank solution. Beer's law is obeyed from 0 to 0.18 μg of Be per ml and the complex has a molecular extinction coefficient of 19,200 at 526 mμ, corresponding to 0.00047 μg of Be per cm^2 on the Sandell scale. The color is stable for at least 48 hr, and has a temperature coefficient of −0.4% per °C in the range 15 to 35°C. The relative standard deviation at the level of 0.10 μg of Be per ml was found to be ±0.4%. Only Ti and large amounts of Mn and Zr cause significant interference. (P.C.H.)

28234 A RAPID METHOD OF TUNGSTEN DETERMINATION IN STEELS BY MEASURING BACKSCATTERING OF BETA PARTICLES. Ludwik Gorski and Andrzej Lubecki (Inst. of Nuclear Techniques, Academy of Mining and Metallurgy, Krakow). Chem. Anal. (Warsaw), 10: 191-7(1965). (In Polish)

Use of the backscattering of beta particles in determination of tungsten content in the 16 to 20% range, in tool steel, was examined. $^{90}Sr + ^{90}Y$ in a small lead container was the source of beta particles. A scintillation counter with a plastic scintillator was used for detection of beta particles reflected off samples. Pulses from the counter after passing through an amplifier and a discriminator were counted by a rapid scaler. The geometry of the system, source-sample-counter, assured the detection exclusively of backscattered beta particles. Measurement time was about 1 minute. No chemical treatment of samples was needed. The total relative standard deviation was about 0.09% for the 16 to 20% range of tungsten. (auth)

28235 DETERMINATION OF THE EFFICIENCY OF AUTORADIOGRAPHIC DETECTION OF TRITIUM ON STRIPPING FILM USING AN INTERNAL GAS COUNTING TUBE. R. Tykva and J. Vesely (Inst. of Organic Chemistry and Biochemistry, Czechoslovak Academy of Sciences, Prague). Collection Czech. Chem. Commun., 30: 898-9 (Mar. 1965).

Determination of the number of tritium decays, necessary for the blackening of potassium bromide grains, in stripping film is described. The experimental conditions affecting these phenomena were determined. (auth)

28236 COMPLETE CONVERSION OF ORGANIC COMPOUNDS INTO GASEOUS PRODUCTS FOR SIMULTANEOUS DETERMINATION OF ^{3}H AND ^{14}C IN PROPORTIONAL COUNTERS. P. Jordan and Ph. A. P. Lykourezos (Eidgenossische Technische Hochschule, Zurich). Helv. Chim. Acta, 48: 581-90(1965). (In German)

A pyrolytic method is described for simultaneous determination of ^{3}H and ^{14}C in organic materials using gas proportional counters. This method allows the hydrogen and carbon of these substances to be totally converted to gaseous reaction products in a single operation. (tr-auth)

28237 ON THE STABILITY OF SOME LIQUID SCINTILLATOR SOLUTIONS. K. Joon and P. A. Deurloo (Institutt for Atomenergi, Kjeller, Norway). Intern. J. Appl. Radiation Isotopes, 16: 335-6(May 1965).

It is shown that cations, if brought into a scintillator liquid, do not always form stable solutions if no special precautions are taken. The activity losses of natural uranium, ^{106}Ru, ^{144}Ce, ^{95}Zr, and ^{137}Cs in a liquid scintillator solution containing TOPO (trioctylphosphine oxide) when plutonium is present are compared to those when no plutonium is present. The aim of the work is quantitative determination of plutonium in pure solutions, as well as in the presence of natural uranium and fission products. The TOPO eliminated loss of activity as a function of time. (M.C.G.)

28238 POLAROGRAPHIC REDUCTION OF NITRATE IONS IN THE PRESENCE OF ZIRCONIUM SALTS. H. Whitney Wharton (Procter and Gamble Co., Cincinnati). J. Electroanal. Chem., 9: 134-9(Feb. 1965).

Studies showed that the irreversible polarographic reduction of the nitrate ion in the presence of 0.1 M zirconium as supporting electrolyte is not catalytic, but rather involves the reduction of distinct $Zr-NO_3$ complexes. The nature of the reducible species is dependent on the relative and absolute concentrations of the zirconium and nitrate ions. It is also apparent that the age of the solution of zirconium used as supporting electrolyte affects the character of the nitrate polarographic wave. Freshly prepared solutions of zirconium give nitrate waves that are poorly resolved from the hydrogen discharge wave of the supporting electrolyte. Zirconium solutions aged for at least two weeks give well-defined, completely resolved waves ideally suited for analytical use. Using aged 0.1 M zirconyl chloride solutions as supporting electrolyte, a constant i_d/C_{NO_3} ratio was obtained over a wide range of nitrate ion concentration ($2.4 \cdot 10^{-5}$ to $2 \cdot 10^{-2}$ M). (auth)

28239 NEUTRON ACTIVATION ANALYSIS IN SCIENTIFIC CRIME DETECTION—SOME RECENT DEVELOPMENTS. Rodney R. Ruch, John D. Buchanan, Vincent P. Guinn, Sandra C. Bellanca, and Raymond H. Pinker (General Atomic Div., General Dynamics Corp., San Diego, Calif.). J. Forensic Sci., 9: 119-33(Jan. 1964).

A preliminary survey was made of the possibilities of trace element neutron activation analysis characterization of many kinds of material of interest in criminalistic investigations: plastics, rubber, greases, wood, glass, paper, ink, and soil. With the exception of ink (on paper), these preliminary results are encouraging. A technique for the detection of gunpowder residues on the gun hands of suspects, by neutron activation analysis of hand swabbings for traces of Sb and Ba, appears to be a promising technique. The method involves the removal of any residues from the hand of a suspect, activation of the swabbings in a nuclear reactor, rapid radiochemical separation of the ^{122}Sb and ^{139}Ba, and γ-ray spectrometry of the separated species. Results obtained indicate that the Ba/Sb ratios are significantly different in revolver ammunitions (so that it may be possible to ascertain from the analysis of the residue the manufacturer of the ammunition fired). Also, some evidence obtained indicates the possibility of determining the number of times a person has fired a gun (from the amount of residue found). In addition, studies of the distribution of the residue on various parts of the gun hand may indicate the type of weapon fired (revolver, automatic pistol, rifle, shotgun). (BBB)

28240 A STUDY OF PYROGALLOL DERIVATIVES OF THORIUM. R. P. Agarwal and R. C. Mehrotra (Univ. of Gorakhpur, India). J. Indian Chem. Soc., 42: 61-6 (Feb. 1965).

Complex forming reactions of thorium with pyrogallol were studied by potentiometric and preparative techniques. Equilibrium constants for the reactions: $Th^{4+} + C_6H_3(OH)_3 \rightleftharpoons [Th(C_6H_3O_3)]^+ + 3H^+$ and $Th^{4+} + 2C_6H_3(OH)_3 \rightleftharpoons Th(C_6H_4O_3)_2 + 4H^+$ were found to be 4.786×10^{-7} and 5.035×10^{-3}, respectively. Sodium and potassium compounds, $M_2[Th(C_6H_3O_3)_2] \cdot 7H_2O$, were isolated. Potentiometric titrations of thorium nitrate with KOH in presence of pyrogallol showed a sharp inflection at four equivalents of alkali per mole of thorium ion, indicating the possibility of an electrometric method for estimation of thorium. (auth)

28241 DETERMINATION OF RUBIDIUM IN SEAWATER. Raymond C. Smith, K. C. Pillai, Tsaihwa J. Chow, and Theodore R. Folsom (Univ. of California, San Diego, La Jolla). Limnol. Oceanog., 10: 226-32 (Apr. 1965).

Rubidium concentrations in seawater from various locations and depths to 3,900 m were determined using two independent techniques—direct flame photometry and mass spectrometry. Results of these two techniques agree within estimated errors and indicate that the rubidium content in the oceans is uniform within ±8% with values varying about 120 μg/liter. Sediment from the sea floor below a depth profile, analyzed for rubidium and potassium, gave a rubidium concentration factor of 150 and a potassium to rubidium ratio of 1,270. (auth)

28242 METHODS FOR THE ANALYSIS OF FERRO-NIOBIUM. H. Green. Metallurgia, 71: 199-201(Apr. 1965).

In the method described for analysis of ferro-niobium, the tantalum and most of the niobium and titanium are precipitated from a tartaric acid solution. The remainder of the niobium is determined by reaction with thiocyanate, extraction of the niobium thiocyanate using a chloroform solution of a liquid anion exchange, and measuring the absorption spectrophotometrically. Iron is also measured spectrophotometrically and aluminum polarographically Silicon is determined gravimetrically by weighing as silica and titanium spectrophotometrically. (auth)

28243 THE ANALYTICAL APPLICATION OF CERIUM–THORON CHELATE IN THE ANALYSIS OF CERIUM. Satendra P. Sangal (Univ. of Allahabad, India). Microchem. J., 9: 9-15(Mar. 1965).

Cerium(III) and thoron form a pink-colored chelate (λ_{max} 500 mμ) in the ratio of 1:2 (metal : chelating agent) at pH 4.0, temperature 25°. The chelate is stable between pH 3.5 and 7.5. The value of log K as determined by different methods is 8.5 ± 0.2. The system adheres to Beer's law from 0.37 to 10.0 ppm of cerium. The sensitivity of the reaction is 0.07 γ per square centimeter. (auth)

28244 LANTHANUM – ALIZARINE RED S CHELATE. Santendra P. Sangal (Univ. of Allahabad, India). Microchem. J., 9: 26-37(Mar. 1965).

Lanthanum and Alizarine Red S form a pink-colored chelate with maximum absorbance at 520 mμ. The molar ratio of lanthanum to the chelating agent was determined to be 1:2, using three different methods: the mole ratio method, the slope ratio method, and the method of continuous variations. The chelate is stable between pH 3.5 and 6.5. The value of log k (log k = stability constant), the mole ratio method, and the method of continuous variations, is 8.6, 8.6, and 8.3, respectively. (auth)

28245 SCANDIUM–ETHYLENEDIAMINE TETRAACETIC ACID TITRATIONS. Satendra P. Sangal (Univ. of Allahabad, India). Microchem. J., 9: 38-41(Mar. 1965).

Complexometric determinations of scandium with Alizarine Red S, thoron, and Murexide as chelatochromic in-

dicators are reported. The effects of pH on the titer value, the range of concentration, and the interferences due to foreign ions were studied in detail. (auth)

28246 DETERMINATION OF ENRICHED URANIUM IN THE URINE BY MEANS OF ITS CHROMATOGRAPHICAL ISOLATION ON A KEL-F COLUMN IMPREGNATED WITH TRIBUTYL PHOSPHATE AND SUBSEQUENT ALPHA COUNT. C. Testa and G. Masi (Comitato Nazionale per l'Energia Nucleare, Casaccia, Italy). Minerva Nucl., 9: 22-5(Jan.-Feb. 1965). (In Italian)

A method was developed for determination of enriched uranium in the urine by use of a KEL-F column (polytrifluorochloroethylene) supporting TBP. The urine is partially mineralized by boiling with nitric acid. The molarity of the nitric acid was brought to 7.5M and the solution was passed on the column prebalanced with the same acid at a flow rate of 1 cm^3/min. The column was then washed with 20 ml of 7.5 M HNO_3 and the uranium was diluted with 15 ml of water. After having concentrated the solution to about 1 ml the remains were transferred to a platinum tray, calcination was carried out and alpha activity was determined by means of a scintillation counter. From the tests carried out with urines labeled with variable quantities of uranium (0.3 to 3 cpm) efficiency was 91%. About 3 hours are necessary for making the sample ready for counting; it is also possible to work with a series of columns and regenerate them for at least ten cycles. To increase the sensitivity of the method a liter of urine can also be used: in this case, before passing on the column, the uranium is precipitated with phosphoric acid and ammonia at pH 10, the precipitate washed with 3M ammonia, and dissolution of the precipitate in 7.5M HNO. (auth)

28247 ACID LEACHING OF THORIUM CARBIDE. [PART] II. Hisashi Imai and Shinobu Uruno (Japan Atomic Energy Research Inst., Tokyo). Nature, 206: 691-3 (May 15, 1965).

Acid leaching of ThC at room temperature and 100°C using hydrochloric, sulfuric, and nitric acids was investigated. A pellet of ThC in HCl disintegrated spontaneously with the liberation of gas with acetylene-like smell. Almost all the ThC was dissolved in HCl in the concentration of 0.5–12 N. The solubility of ThC in H_2SO_4 at room temperature was 3.3% for 10 N and 3.2% for 24 N, whereas at 100°C it turned into 6.8 and 3.5%, respectively. The effect of temperature on dissolution of ThC was small, and this result indicated that the principal factor for H_2SO_4 leaching is the concentration of the acid, namely, the solubility of $Th(SO_4)_2$ in the solution. At 100°C, the dissolution rate of ThC in 6 N HNO_3 was slow. When leached for 24 hr, 77.6% of the total Th was dissolved in the solution, and the solubility resulted in 95.5% for 48 hr. Only a small proportion of ThC was leached with HNO_3 in the concentration range of 2–11 N, at room temperature, but the solubility increased rapidly again to 64.0% at 12 N. (P.C.H.)

28248 USES OF ACTIVATION ANALYSIS FOR CRIMINAL PROBLEMS. I. CAR PAINT. A. Wyttenbach (Eidgenossisches Institut fur Reaktorforschung, Wurenlingen, Switzerland). Neue Tech., 7: 85-92(Apr. 1965). (In German)

Instrumental activation analysis was applied to the problem of identifying traces of automobile paint. The activities induced by thermal neutron bombardment were determined in nine samples of the same color, but not of the same origin. The reproducibility of the results and the homogeneity of the paints were studied. It could be demonstrated that the identity of two samples can be proven or excluded with a high degree of certainty. (auth)

28249 ON THE DETERMINATION OF THE ISOTOPIC COMPOSITION OF POTASSIUM BY NEUTRON ACTIVATION. Mutsuaki Shinagawa, Akira Oyoshi, and Emiko Oyoshi (Osaka Univ.). Nippon Genshiryoku Gakkaishi, 7: 186-90(Apr. 1965). (In Japanese)

The isotopic ratio of $^{41}K/^{39}K$ was determined by neutron activation analysis. Potassium nitrate samples were treated in fused state with zirconyl phosphate as an ion exchanger to separate the isotopes, and irradiated for 10 min in JRR-1. A standard reference sample of KNO_3 possessing the natural isotopic ratio was irradiated in the same manner. After irradiation, the activity of ^{42}K produced by the $^{41}K(n,\gamma)^{42}K$ reaction was measured with a 256-channel pulse-height analyzer. The isotopic ratios of unknown samples were calculated from the specific activities of the unknown and standard samples. The separation ratio E is defined as follows: $E = [^{41}K/^{39}K]_{unknown}[^{41}K/^{39}K]_{std.} = S_b/S_a$, where S_a and S_b are specific activities of the unknown and the standard samples, respectively. The result of neutron activation was slightly affected by the irradiation geometry of the samples, but the uniformity of the neutron flux could be calibrated by parallel tests using standard samples. The results obtained were not quite as accurate as mass-spectrometrical data. The neutron activation method can be used as a convenient technique where a number of samples must be analyzed at the same time. (auth)

28250 PARTITION CHROMATOGRAPHY OF TRANSURANIUM ELEMENTS IN THE SYSTEM TBHP–TBPP/PERCHLORIC ACID. [PART] II. Ya. Mikulski, K. A. Gavrilov, and V. Knobloch (Inst. of Nuclear Physics, Krakow and Inst. of Nuclear Research, Czechoslovakian Academy of Sciences). Nukleonika, 10: 81-7(1965). (In Russian)

The extraction properties of the transuranium elements (Am, Cm, Fm, and Md) were studied using the method of partition chromatography with reversed phases in the system TBHP–TBPP(1:1)–$HClO_4$. The partition and separation coefficients for the pairs of elements Eu–Am, Eu–(Fm,Md), (Fm, Md)–Am, were calculated based on the data obtained from the extraction method and on the maximums of the chromatograms. (auth)

28251 ON THE SENSITIVITY OF RADIOMETRIC ABSORPTION ANALYSIS. Bohdan Dziunikowski (Inst. of Nuclear Technology, Krakow). Nukleonika, 10: 107-14 (1965).

The sensitivity of the absorption analysis in the general case, when the heavy element content is determined in the samples containing the admixtures of the elements with intermediate atomic numbers is discussed. A universal formula taking into account the influence of these interelements on the sensitivity of the analysis, is given. The sensitivity of two-channel nomographic absorption analysis is also defined. The formulas presented give the possibility of determining experimentally the sensitivity and the accuracy of this method. (auth)

28252 FIELD METHOD FOR RAPID COLLECTION OF IODINE 131 FROM MILK. Charles R. Porter and Melvin W. Carter (Public Health Service, Montgomery, Ala.). Public Health Rept. (U. S.), 80: 453-6(May 1965).

A field method for rapid collection of ^{131}I from milk that involves adsorption of ^{131}I on anion exchange resin and determination of its activity by gamma counting is described. (P.C.H.)

28253 LIQUID-LIQUID, DISCONTINUOUS, COUNTERCURRENT SOLVENT EXTRACTION FOR DETERMINATION OF TRACE CONSTITUENTS IN GEOLOGICAL MATERIALS. [PART] II. EXTRACTION WITH SOLVENTS HEAVIER THAN WATER. R. R. Brooks (Massey Univ., Palmerston North, N. Z.). Talanta, 12: 511-16(May 1965).

An analytical technique was developed for the determination of trace elements in sea water and other natural waters. The method consists of the use of liquid-liquid, countercurrent, solvent extraction with solvents heavier than water. Relatively large volumes of sea water form the moving aqueous layer in the extraction procedure, whereas the lower stationary layer comprises the chelating agents dithizone or 8-hydroxyquinoline dissolved in carbon tetrachloride and chloroform, respectively. Elements are progressively absorbed from the sea water as the aqueous layer passes along the extraction train. Trial experiments with sea water containing additives show that solutions of 8-hydroxyquinoline and to a lesser extent dithizone are

capable of quantitatively retaining a number of elements in a small number of extraction tubes. An experiment was carried out with a sample of pure sea water from which Mn, Pb, Mo, Sn, Ni, Al, V, Ag, Zn, and La were quantitatively extracted into a solution of 8-hydroxyquinoline in chloroform; the elements were all determined spectrographically. It is considered that the method should have wide applications in the analysis of trace elements in sea water because enrichment factors of 400,000 are obtained for the concentrations of these elements. The technique is simple and comparatively free from errors caused by contamination. (auth)

28254 SIMPLIFIED ESTIMATION OF UPPER LIMITS IN NEUTRON ACTIVATION ANALYSIS. H. R. Lukens, Jr. (General Atomic, San Diego, Calif.). Trans. Am. Nucl. Soc., 8: 83-4(May 1965).

28255 NEUTRON-ACTIVATION METHODS USED FOR ROUTINE CERAMIC COATING TESTING. R. C. Barry and T. L. Iliff (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 8: 85-6(May 1965).

28256 DERIVATIVE ACTIVATION ANALYSIS OF ZINC. Lowell T. Harmison (Hittman Associates, Inc. Baltimore), S. Lakshmanan, and D. Duffey. Trans. Am. Nucl. Soc., 8: 86(May 1965).

28257 CONTINUOUS ANALYSIS OF TRACE FLUORINE BY 14-Mev NEUTRON ACTIVATION. S. Nargolwalla and R. E. Jervis (Univ. of Toronto). Trans. Am. Nucl. Soc., 8: 86-7(May 1965).

28258 MEASUREMENT OF HYDROGEN IN HYDROCARBONS BY SLOW NEUTRON TRANSMISSION. William E. Mott and Donald F. Rhodes (Gulf Research and Development Co., Pittsburgh). Trans. Am. Nucl. Soc., 8: 87-8(May 1965).

28259 DETERMINATION OF PLUTONIUM IN KILOGRAM SOIL SAMPLES BY GAMMA-SPECTROMETRY OF Am-241. H. E. Menker and J. D. Buchanan (Hazleton-Nuclear Science Corp., Palo Alto, Calif.). Trans. Am. Nucl. Soc., 8: 88(May 1965).

28260 A SYSTEM FOR REMOTE MICROSAMPLING OF IRRADIATED FUEL WITH MICRON-SCALE RESOLUTION. P. E. Novak, P. A. Bohm, R. W. Darmitzel, A. L. Kaznoff, and E. L. Zebroski (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 8: 169-70 (May 1965).

28261 COLORIMETRIC ESTIMATION OF URANIUM WITH β-DIKETONES. D. Purushottam and M. Atchaiaii (Andhra Univ., Waltair, India). Z. Anal. Chem., 196: 95-7(July 4, 1963).

β-Diketones give an intense yellow color with U and can be used for its colorimetric estimation. Two such reagents are dithenoyl methane and pongamol. With the former, as little as 0.02 ppM, and with the latter, as little as 0.8 ppM of U can be estimated. In the method described a uranyl standard working solution was prepared from a stock solution which gave uranium oxide (U_3O_8) content of 0.0842 mg/ml for dithenoyl methane complex and 0.028 mg/ml for pongamol complex. Recrystallized samples of the reagents were used in the concentration 0.0236 mg/ml of dithenoyl methane and 0.03 mg/ml of pongamol. Absorption measurements were made in a spectrophotometer with a tungsten filament lamp and a filter in the uv region. Aqueous 60% acetone was found to be convenient for the colorimetric U estimation. In both cases the maximum difference of absorption between the reagent and the complex occurs at 420 μm. Optical densities at 420 μm were measured for the two complexes and show that the U-dithenoyl methane complex obeys Beer's law from 0.02 to 8 ppM of U and the pongamol complex from 0.8 to 10 ppM. Study of the composition of the complexes by Job's method indicated that the composition is 2:1, ligand to metal. The molar ratio method confirmed these data. Thorium and rare earths interfere, even in low concentrations. (BBB)

28262 ON THE SOLUBLE ULTRAFILTER OF ALUMINUM AND LANTHANUM ALGINATE AND ELECTRON MICROSCOPIC DEMONSTRATION OF THEIR FILTRATION PROPERTIES. Georg Moll (Universitat, Kiel). Z. Hyg. Infektionskrankh., 149: 297-314(Oct. 25, 1963). (In German)

A new type of biological filter was developed using a membrane of alginic acid precipitated with La and Al ions. Alginic acid, a mixed polymer of D-mannuronic acid and L-glucuronic acid was solubilized as the Na salt and precipitated by aqueous solutions of $La(NO_3)_3$ or $AlCl_3$ on a filter paper disk. The filter membrane so formed was washed in Na citrate solution. Electron microscopy was used to demonstrate the fine structure of the filter, which showed three zones: an outer gel-like membrane, an inner layer of La- or Al-alginate fibers lying parallel to the filter itself and an inner perpendicular array of fibers. The outer membranes provide a web-like structure of elongated fibrils. Theoretical aspects of filter formation are discussed with emphasis on the influence of La and Al ion on alginate fiber deposition and arrangement. Electron microscopy was also used to demonstrate the retention by this ultrafilter of bacteria (Escherichia coli), viruses (E. coli T2 phage), and colloids (Au sol). The colloidal Au indicated the pore size of the La and Al alginate filter to be ~50 to 100 Å. (BBB)

28263 IONIZATION DETECTORS IN GAS CHROMATOGRAPHY. Eleonore Thom. Z. Instrumentenk., 72: 166-70(1964). (In German)

Ionization detectors for gas chromatographic analyses are described. They are extremely sensitive for detection of organic or inorganic compounds. The gas chromatographic method could be extended to the range of extremely small sample sizes. Another advantage is the sensitivity of these detectors, which may facilitate qualitative analyses. (auth)

28264 NEUTRON ACTIVATION METHOD FOR DETERMINATION OF RHENIUM IN METEORITES AND MOLYBDENITES BY MEANS OF A SUBSTOICHIOMETRIC SEPARATION. G. A. Perezhogin (Vernadskii Inst. of Geochemistry and Analytical Chemistry, USSR). Zavodsk. Lab., 31: 402-3(1965). (In Russian)

Methods were developed for the neutron activation determination of rhenium in meteorites and molybdenites with the use of substoichiometric extractions, which included the purification of technetium. (tr-auth)

28265 EVALUATION OF THE BACKGROUND IN THE X-RAY SPECTRAL ANALYSIS OF RARE EARTHS. R. A. Kravchenko-Berezhnoi and L. I. Polezhaeva (Kirov Inst. of Geology, Academy of Sciences, USSR). Zavodsk. Lab., 31: 436-40(1965). (In Russian)

Methods for the measurement of the intensity of the background precisely at the wavelength of the analytical lines determining the elements in uncontaminated oxides of one of the rare earth elements were proposed. There was no superposition on the proposed lines. Tables were constructed for correction coefficients, permitting the dependence of the intensity of the analytical lines of the elements to be determined on the superposition caused by other rare earths to be considered. (tr-auth)

28266 X-RAY SPECTRAL ANALYSIS OF STRONTIUM, THULIUM, AND LUTETIUM BERYLLIDES. V. N. Karev and L. I. Reshetova. Zavodsk. Lab., 31: 440-1(1965). (In Russian)

For confirmation of the stoichiometric formula $MeBe_{13}$ (beryllides of strontium, thulium, and lutetium) x-ray analysis on the secondary spectrum was performed. The analysis was carried out by the method of exterior standards. Data from the x-ray structural and x-ray spectral analysis of the compounds were in satisfactory agreement in the limits ±5%. (tr-auth)

28267 X-RAY SPECTRAL AND FLUORESCENT METHODS FOR DETERMINATION OF RARE EARTHS IN SOLUTIONS. G. I. Rekhkolainen. Zavodsk. Lab., 31: 442-3(1965). (In Russian)

Methods for the x-ray fluorescence determination of rare earths in solutions, intermediate products of their ion exchange separation, were proposed. The sensitivity of the analysis for elements of the cerium subgroup (La to Nd) was 1.0 to 0.2 g/l, for the other rare earth elements it was 0.1 g/l. The mean square error of the analysis was 5 to 8%. The time necessary for one determination does not exceed 5 minutes. (tr-auth)

28268 PECULIARITIES OF THE PROCESSES INFLUENCING THE RESULTS OF SPECTROGRAPHIC ANALYSIS OF POWDERS INJECTED INTO THE ARC PLASMA. A. K. Rusanov and N. T. Batova (All-Union Scientific-Research Inst. of Mineral Resources, Moscow). Zh. Analit. Khim., 20: 415-20(1965). (In Russian)

Processes influencing the intensity of spectral lines when a substance is evaporated from the electrode channel or powders injected into an arc discharge plasma are considered. The effects of adhering particles, before and after their feeding into the arc cloud, on the intensity of spectral lines when powders of different composition and degree of dispersion are blown into the carbon arc plasma were determined. It was found that the gangue rock composition does not considerably influence the intensity of spectral lines of the elements determined; the systematic experimental errors in the analysis of ores were principally due to the change of the composition of particles (carriers of the elements determined) present in the rock. (auth)

28269 LUMINESCENT DETERMINATION OF URANIUM(VI) IN CARBONATE SOLUTIONS IN THE PRESENCE OF DIBUTYL PHOSPHATE. T. S. Dobrolubskaya. Zh. Analit. Khim., 20: 470-2(1965). (In Russian)

The effect of dibutyl phosphate on the uranium(VI) luminescence in solutions was studied. It was established that uranium(VI) in carbonate solutions containing dibutyl phosphate can be determined by the luminescence method. The solution is diluted with a 5% solution of phosphoric acid and then the luminescence intensity is measured. The use of 12% H_2SO_4 is not expedient since in that case the luminescence intensity is three times lower. The accuracy of the determinations was ±4% at concentrations of from 0.1 to 1 g/l of uranium. (auth)

28270 RADIOCHEMICAL METHODS OF ANALYSIS. VOLUME I. Proceedings of the Symposium Held by the International Atomic Energy Agency at Salzburg, 19-23 October 1964. (International Atomic Energy Agency, Vienna). Proceedings Series. Feb. 1965. 441p. (STI/PUB/88 (Vol.I); (CONF-641001(Vol.I)). $9.00; S 189.-; £2.14.0; F.Fr. 36.-; DM 31.50(IAEA).

Twenty-nine articles are included; separate abstracts were prepared for 7. Twenty-two articles on history of isotopic tracers in analytical chemistry, radiochemical methods of analysis, reactor activation analysis, use of radioactive sources, and use of accelerators were previously abstracted in NSA as 18: 43387 and 19: 2212, 2238, 5776, 5817, 5820, 5822, 5824, 5829, 5830, 5832, 5833, 5834, 5836, 7332, 7337, 7339, 7340, 7341, 7345, 7349, and 7351. (P.C.H.)

For abstracts of individual papers see: 28271, 28272, 28273, 28274, 28275, 28276, and 28277.

28271 NEUTRON ABSORPTION IN PILE NEUTRON ACTIVATION ANALYSIS: DETERMINATION OF COPPER AND GOLD IN SILVER. O. T. Hoegdahl (Central Inst. for Industrial Research, Oslo). p.23-40 of STI/PUB/88 (Vol.I).

A method is given to calculate the effects of neutron absorption in pile neutron activation analysis approximately. The absorption effects of the thermal and epithermal neutrons are treated separately by assuming a neutron spectrum composed of a Maxwellian distribution plus an epithermal dE/E-distribution cut off at a suitable lower limit of velocity. The average thermal neutron density inside the sample is used as a measure of the effect of the thermal neutrons. A comparison between theoretical and experimental values for the ratio of the average thermal neutron density inside the sample to the unperturbated thermal density is given for spherical samples of cobalt, silver, gold, and tungsten, and for powdered cobalt samples. The effect of the absorption of the epithermal neutrons is shown to depend on the cadmium ratio and in a complex manner on the composition of the sample. A calculation of this effect on the pile neutron activation analysis of copper and gold in spheres of silver is given as an illustration of the calculations involved. Agreement between computed and observed values was satisfactory. (auth)

28272 PLANNING OF ACTIVATION ANALYSIS IN HIGH NEUTRON FLUX. I. A. Maslov (Ioffe Inst. of Physics and Tech., Leningrad). p.41-50 of STI/PUB/88(Vol.I). (In Russian)

The increase in sensitivity of determination of microimpurities in materials of a high degree of purity resulting from the use for activation of neutron fluxes of the order of 10^{14} n cm^{-2} s^{-1} and above is subject to a number of limitations. These result, firstly, from secondary activation of the radioisotope to be identified, secondly, from the burning out during irradiation of the stable nuclei of the impurity to be determined and, thirdly, from the increased systematic error in the results of the analysis as a result of an increase in the probability of interference reactions on fast neutrons. On the basis of experience in conducting analyses on the VVR-M reactor, with a neutron flux of up to 3×10^{14} n cm^{-2} s^{-1}, mathematical expressions for objectively assessing sensitivity in high neutron flux are proposed. The activation conditions at a flux of 1×10^{14} n cm^{-2} s^{-1} were shown to be qualitatively different in a number of cases, in that there was a substantial difference in the rate of formation of the isotope to be identified from what would be expected in conjunction with its half life. Two auxiliary coefficients are proposed to correct the systematic error in the results; one of them makes it possible to assess the effect of the impeding impurity directly during the course of the analysis, the other when checking for the presence of the impeding element, either by a non-radioactive method or from the final results of the analysis. Mathematical expressions are given for finding the numerical values of these coefficients when allowing for the nuclear reactions interfering in relation to the radioisotope in question. The compilation of tables of values for the coefficients for checking the size of the systematic error for the isotopes that are to be identified for the impurities to be determined, and also of tables for the correction coefficients for the expected sensitivity value, are shown to facilitate considerably the planning of activation analysis in conditions of high thermal neutron flux. (auth)

28273 USE OF RADIOACTIVATION TO DETERMINE IMPURITIES IN SUBSTANCES OF A HIGH DEGREE OF PURITY. Yu. V. Yakovlev and N. N. Dogadkin (Inst. of Geophysics and Analytical Chemistry, Academy of Sciences, USSR). p.187-95 of STI/PUB/88(Vol.I). (In Russian)

Methods using radioactivation for the determination of impurities in pure substances are discussed. The activation analysis of high-purity indium, used for synthesizing intermetallic compounds, gives rise to considerable difficulties. The large activation cross section of the macrocomponent leads to high activity of the irradiated sample, and to self-absorption of the neutrons in it. The first circumstance made it necessary to develop a method of rapidly separating the active macrocomponent and carefully removing from it the impurities to be determined. The active indium was separated by extraction with di-isopropyl ether from 4.5 N HBr in a continuous mechanical extractor. The impurities to be determined were removed by distillation, extraction and precipitation. The second circumstance made it necessary to establish, by the change in specific activity of the preparations, the degree of self-absorption as a function of the weight of the sample. The sensitivity of the determination of copper, zinc, arsenic, antimony, and gold in indium when a weighed sample of 100 mg was irradiated for 12 hr with a flux of 8.7×10^{12} n cm^{-2} s^{-1} was between $n \times 10^{-6}$ and $n \times 10^{-8}$%. Activation analysis is the only method

that permits determination of traces of individual rare earth impurities in rare earth elements of a high degree of purity. The determination of dysprosium in yttrium oxide is complicated by the short half-life of ^{165}Dy (138 min). A method was developed based on the chromatographic separation of traces of Dy and 10 mg of yttrium on micro-columns containing AV-17 anion-exchange resin, elution using a 0.1 N solution of sodium ethylenediaminotetraacetate, followed by measurement of the activity of the Dy fraction on a 100-channel γ spectrometer. The analysis takes one hour. The sensitivity of the determination of Dy on irradiating 10 mg of yttrium oxide for 5 min with a flux of 1.2×10^{13} n cm^{-2} s^{-1} is 1×10^{-6}%. (P.C.H.)

28274 TRACING AND TRACE-ELEMENT COMPOSITION OF SNAKE VENOM BY ACTIVATION ANALYSIS. B. Moav (Beilinson Hospital, Petah-Tikva, Israel), S. Gitter, Y. Wellwart, and S. Amiel. p.205-16 of STI/PUB/88(Vol.I).

The dialyzed venoms of various snakes were examined and found to contain large concentrations of copper (~1000 ppm) and zinc (~500 ppm). A systematic activation analysis study was carried out with the aim of using these trace metals as internal tracers, and studying the relation between chemical nature, biological activity, and trace metal content in the different venom fractions. The Vipera palestinae venom was separated into different fractions using gradient precipitation, paper electrophoresis, and ion exchange chromatography. It was found that both Cu and Zn are protein bound and distributed throughout all venom fractions, varying in the range 100 to 3000 ppm. Since the estimated molecular weight of venom protein is in the range 10^4 to 10^5, it appears that each venom molecule contains on the average about one Cu atom and somewhat less Zn. Two difficulties were encountered in tracing the spread of venom by the activation analysis of Cu: the small amounts of venom (~mg containing ~1000 ppm Cu) are diluted in more than 1000 times larger quantities of tissue (~1 g containing 1-10 ppm Cu); and the natural distribution of Cu in the tissues of experimental animals varies greatly (σ_{50}%). Attempts are being made to use in vivo labeling of the venom with copper enriched in ^{63}Cu, and to use the ^{65}Cu/^{63}Cu isotope ratios measured by activation analysis for tracing. Attempts to relate the protein content (measured by optical density), venom toxicity (LD50 of intraperitoneally inoculated mice), and trace metal content (Cu and Zn measured by activation analysis) of Vipera palestinae venom fractions, have so far not disclosed any distinct dependence of characteristic features on Cu or Zn content. However, it was established that the neurotoxins contain five times more Cu (~2120 ppm) than hemorrhagin (~395 ppm) when the dialyzed whole venom contains ~800 ppm Cu. On the other hand, the distribution of Zn is relatively low in the neurotoxins (~420 ppm) and high in the hemorrhagin (~660 ppm), the dialyzed whole venom containing 350 ppm. (P.C.H.)

28275 ANALYSIS OF ORE SAMPLES USING GAMMA-RAYS EMITTED UNDER IRRADIATION WITH A LOW-LEVEL NEUTRON SOURCE. R. Christell and K. Ljungren (Isotope Techniques Lab., Stockholm). p.263-75 of STI/PUB/88(Vol.I).

Two nucleonic methods suitable for the continuous analysis of iron ore in a process stream were investigated and compared. Both methods are based on the irradiation of a sample with neutrons and the simultaneous measurement of the γ radiations produced. Irradiation with fast neutrons will produce γ radiation due to inelastic scattering of the neutrons, and irradiation with thermal neutrons will produce γ radiation due to radiative capture of the neutrons. In the first place the assessment of iron in iron ore was investigated using a 0.5 C ^{239}Pu-Be neutron source. The ore samples were contained in Lucite boxes (300 mm × 200 mm × 30 mm) and the γ radiation was measured with a scintillation detector and a 400-channel pulse-height analyzer. Capture γ rays: When thermal neutrons are captured in iron according to the reaction ^{56}Fe(n,γ)^{57}Fe, γ rays of several energies are produced. The capture cross-section is 2.55 b. In a series of ore samples containing varying amounts of iron, the 7.64-Mev γ radiation was measured. The neutron source was contained in a cylindrical paraffin moderator and the sample to be measured was placed on the upper surface of the moderator. The γ radiation was measured with a NaI(Tl)-crystal scintillation detector (crystal diameter 7.6 cm; thickness 7.6 cm). Inelastic scattering γ rays: When fast neutrons are scattered against iron according to the reaction ^{56}Fe(n,n'γ)^{56}Fe the predominant γ radiation produced has an energy of 0.84 Mev. The radiative scattering cross section is 1.36 b for a neutron energy of 4.25 Mev. A large fraction of the neutrons from a ^{239}Pu–Be source has energies near this value. From a series of ore samples, of varying iron contents, the 0.84-Mev γ radiation was measured with a NaI(Tl)-crystal scintillation detector (crystal diameter 3.8 cm; thickness 2.5 cm). The investigations performed are described and an evaluation of the relative merits of the two methods for a continuous assessment of iron in an ore stream is given. (auth)

28276 NEUTRON ACTIVATION ANALYSIS OF NATURAL ROCK FORMATIONS BY MULTICHANNEL SPECTROMETRY. K. F. Kuznetsov, D. I Leipunskaya, I. I. Rogushin, S. I. Savosin, and Yu. S. Shimelevich (Inst. of Geophysics and Geochemistry Research, USSR). p.277-85 of STI/PUB/88(Vol.I). (In Russian)

The possibility of using multichannel spectrometry in neutron activation analysis of natural rock formations is discussed. Methods and results using standard samples of natural materials of known composition are described, and the possibility of performing collective measurements is discussed. Spectrometry equipment requirements are based on the need to record the gamma radiation from induced activity and neutron radiative capture. The drilling equipment developed for neutron activation analysis that is now in serial production is described in relation to the stated requirements. Results obtained using the equipment described under operational conditions are given. (auth)

28277 GAMMA-ACTIVATION ANALYSIS OF ROCK SAMPLES. A. K. Berezin, G. Ch. Vitozhents, V. V. Sulin, and S. I. Shornikov. p.361-89 of STI/PUB/88(Vol.I). (In Russian)

The gamma-activation type of radioactivation analysis of the elementary composition of samples of rock, ores, and other materials is described. The method is based on irradiation of powdered samples of the specimens to be investigated with strong gamma rays from a charged-particle accelerator, and on recording, either at the same time or afterwards, the radiation emitted by the radioactive products of the various photonuclear reactions occurring in the samples when they are irradiated. The threshold nature of photonuclear reactions, the difference in the threshold energy of the reaction as between different nuclei, and the fact that for most types of gamma accelerators it is possible to make an even change in the energy of the activating gamma radiation, make it possible to carry out selective analysis of complex substances into their elements or groups of elements. Another important property of the gamma activation method is that it can be used for analyzing rock and ore samples, etc., for their content of such light elements as carbon, nitrogen, oxygen, phosphorus, sulphur, etc., which are difficult to determine by neutron activation analysis on thermal neutrons, and by a number of other methods of quantitative analysis. The method can also be used to analyze, apart from the above light elements, the content of copper, zinc, zirconium, and many other elements with a degree of sensitivity, accuracy and rapidity sufficient for geological work. The advantages of the gamma activation methods are demonstrated by the results, which are given, its use for quantitative determination of the carbon and oxygen contents of specimens of coal and the zirconium content of zirconium ores and concentrates. The powdered samples, weighing from 5 to 500 g, were irradiated in a beam of betatron bremsstrahlung, with different maximum energies of the activating radiation. After irradiation, the induced radioactivity of the samples was recorded by a gamma scintillation

spectrometer with a multi-channel output pulse analyzer. The differences in the threshold energies of carbon, oxygen, and zirconium, both from each other and from the impeding elements, and also the different characteristics of the radiation products, make it possible to determine unambiguously the radiation generated with a content of tenth and hundredth parts of one percent of the elements investigated. (auth)

28278 DETECTION OF BETA-EMITTING NUCLIDES >1 Mev IN URINE AFTER AN ACCIDENT BY MEANS OF MEASUREMENT OF THE ČERENKOV EFFECT IN A LIQUID SCINTILLATION COUNTING SYSTEM. J. Narrog (Landesinstitut für Arbeitsschutz und Arbeitsmedizin, Karlsruhe, Ger.). Vienna, International Atomic Energy Agency, World Health Organization, 1965, Preprint No. SM-56/33, 10p. (CONF-650302-16)

From IAEA Symposium on Personnel Dosimetry for Accidental High-Level Exposure to External and Internal Radiation, Vienna.

Beta particles >1 Mev in water can be measured by Čerenkov effect in liquid scintillation counters without any further preparations. Experiments were made to apply this method to urine. When experiments were made with unprepared urine, the measurements were unsensitive because of the strong absorption effect. The urine was first cleared by oxidation with $KMnO_4$. The background was very high, because the K of the $KMnO_4$ contains the radioactive ^{40}K, which also emits β rays >1 Mev (1.32 Mev). $NaMnO_4$ was used instead of $KMnO_4$ with better results. The background was about 30 cpm, the lower limit (measured with $^{90}Sr/^{90}Y$) about 1 pc/ml urine. If the content of radioactive ^{40}K in urine cannot be assessed (e.g., by flame-photometric measurement of the K-content in urine) this method gives the same sensitivity like other methods (e.g., burning and measurement in a large-area proportional counting system), in this case (>2 pc/ml). The measurement with the large-area proportional counter and additional assessment of the ^{40}K-β-activity of the urine is more sensitive and more accurate. The above method is useful for a rapid measurement of large body burdens (and following excretion) of β-nuclides > 1 Mev, by an accidental situation. (D.L.C.)

28279 METHOD FOR THE ENRICHMENT OF URANIUM COMPOUNDS. Fredrich Hecht, Paul Antal, and Hans Korkisch (to Österreichische Studiengesellschaft für Atomenergie Gesellschaft m.b.H.). German Patent 1,186,842. Feb. 11, 1965. Priority date May 6, 1959, Austria.

Uranium compounds are enriched from mineral acid solutions by adsorption in anion exchangers. In order to build up complexes a solution of mineral acid in a primary aliphatic alcohol, in a ketone, preferably an acetone, an ether, or an ester, preferably an ethyl acetate, is used. (Gmelin Inst.)

28280 SEPARATION OF METAL VALUES BY CATION EXCHANGE FROM CONCENTRATED PERCHLORIC ACID SOLUTION. K. A. Kraus and F. Nelson (to U. S. Atomic Energy Commission). U. S. Patent 3,188,169. June 8, 1965.

A cation exchange method of separating metal values that is based on the discovery that certain metal values in a perchloric acid–mineral acid solution are strongly adsorbed onto a cation exchange resin while the others are weakly adsorbed is described. The strongly adsorbed metals are Ca(II), Sr(II), Tl(III), Sc(III), Y(III), the rare earth metal values, Fe(III), Ga(III, Th(IV), Sb(V), U(VI), Pu(VI), Np(VI), and elements 95 through 103. Other metal values are weakly sorbed in the valent state usually existing under the oxidizing conditions of the concentrated perchloric acid–mineral acid medium. (AEC)

Inorganic and Physical Chemistry

Refer also to abstracts 28837, 29109, 29228, and 29689.

28281 (AD-607838) MATERIALS AND STRUCTURES. MOLECULAR STRUCTURE AND THERMODYNAMICS PROGRAM. PART I. MOLECULAR STRUCTURE. Semiannual Technical Report, July 1–December 31, 1961. Seymour Siegel (Aerospace Corp., El Segundo, Calif.). Feb. 28, 1962. Contract AF04(647)-930. 31p. (DCAS-TDR-62-57). $2.00(CFSTI).

The laboratory in which the experimental aspects of the Molecular Structures program will be carried out has been designed and constructed. The majority of the main instrumentation to be employed has been assembled and installed. Some of this equipment is described in detail. Two aspects of the program to study the interaction of radiation with matter are described in some detail. The first study involves the interaction of ice with high-energy gamma rays, and a theoretical model is described which predicts the buildup curve of stabilized hydroxyl radicals at 77°K. The second part of the program involves the role of the triplet state in intermolecular energy transfer. Some preliminary results are reported which illustrate the technique by using electron paramagnetic resonance techniques to observe triplet states at low temperatures. (auth)

28282 (AERE-R-4894) THE DECOMPOSITION OF HYDROUS TITANIUM OXIDE IN HIGH-TEMPERATURE WATER. K. C. Barnes and J. C. Waldron (Atomic Energy Research Establishment, Harwell (England)). Apr. 1965. 12p. Dep.; $0.50 (BIS), 2s. 6d. (HMSO).

Tests were made on the ion exchange capacity of the ammonium and potassium forms of hydrous titanium oxide in water at various temperatures. The ammonium form lost almost all its exchange capacity after heating for three hours at 300°C. The potassium form lost 80% of its capacity during one three-hour heating at 300°C and most of the remainder on further treatment. At 200°C, the reaction was slower but equally complete after longer exposure. Only very slight decomposition was observed at 100°C. The exchange ion, K^+ or NH_4^+, was liberated as free alkali. (auth)

28283 (AGN-8143) ALKALI METALS EVALUATION PROGRAM. Quarterly Progress Report, January 1–March 31, 1965. (Aerojet-General Nucleonics, San Ramon, Calif.). May 1965. Contract AT(04-3)-368. 21p. Dep. (mn); $1.00(cy), 1(mn) CFSTI.

The status of the boiling heat transfer and fluid flow studies of K, Rb, and Cs is summarized briefly. In the studies of Rb and Cs thermodynamic and transport properties, some experimental PVT data are given for Cs. Preliminary tests of the oscillating-cup viscosity apparatus are described. Development of equipment for thermal conductivity and viscosity measurements on vapors is summarized. The equations which fit the experimental data on the latent heat of vaporization and vapor pressure of K, are given. (D.L.C.)

28284 (APDA-167) LITERATURE REVIEW OF SODIUM-WATER REACTIONS. J. A. Ford (Atomic Power Development Associates, Inc., Detroit, Mich.). Mar. 15, 1965. Contract AT(11-1)-1280. 46p. Dep.(mn); $2.00 (cy), 1(mn) CFSTI.

A review was made of the literature on the interaction of sodium and water with emphasis on reaction data and information applicable to the design and analysis of sodium-heated steam generators. Reaction chemistry, pressure effects, thermal effects, and reaction products are considered. Tests and analyses of reactions occurring in alkali metal-heated steam generators are also described. (D.L.C.)

28285 (IS-1154) EQUATION OF STATE OF SIMPLE SOLIDS. C. A. Swenson (Ames Lab., Iowa State Univ. of Science and Tech.). [1965]. Contract W-7405-eng-42. 14p. (CONF-650423-1). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From International Conference on Physics of Solids at High Pressures, Tucson, Ariz.

Equation of state data (pressure-volume-temperature) for the alkali metals and the solidified inert gases are of interest in themselves, but also because they provide guidance for the extrapolation to higher temperatures and pressures of data for less compressible solids. The piston-

displacement technique has been used at pressures of up to 20 kbars to obtain equation of state data from 20°K to the melting point for these elementary solids. Certain regularities are found for the pressure-volume relationships in lithium, sodium, and potassium, and the behavior of the inert gas solids can be understood in terms of current theories. In all cases the temperature-dependent portion of the equation of state obeys a Mie-Grueneisen relationship with a bulk modulus which is independent of temperature at constant volume. This behavior can be understood qualitatively in terms of a simple calculation based on the quasi-harmonic theory of lattice vibrations. (auth)

28286 (KFK-280) TERNARE OXIDE DES DREI- BIS SECHSWERTIGEN AMERICIUMS. (Ternary Oxides of Three- to Six-Valent Americium). Karl-Heinz Walter (Kernforschungszentrum, Karlsruhe (West Germany). Institut für Radiochemie). Jan. 1965. 76p. Dep.(mn).

The reactions of AmO_2 with oxides of other elements at high temperatures were investigated. The alkali oxides Li_2O and Na_2O react with AmO_2 under suitable research conditions to ternary oxides with 3-, 4-, 5-, and 6-valent Am. The thermal stability of the individual compounds decreases with increasing valency of Am. The decomposition temperatures are much lower than that of the analogous ternary oxides of U, Np, and Pu. Ternary oxides of 4-valent Am could be prepared with the oxides of Pa and Sr. In the thermal reaction of AmO_2 with the oxides of the elements of the fifth group, a decomposition of the Am(IV) to Am(III) occurs. In these compounds Am in its chemical behavior shows extensive analogies to the rare earth. Because of the self-radiation of ^{241}Am the compounds of Am undergo a change of the lattice parameters with increasing storage time. This is produced through the transposition of the lattice units to interstitial lattice positions through the α-particles emitted and the recoil atoms occurring in the decay. The time behavior or the relative alteration of the lattice constants were followed in the compounds AmO_2, $Am_2Hf_2O_7$, and Li_4AmO_5. The ternary and quarternary oxides prepared with the results of x-ray studies are tabulated. (tr-auth)

28287 (KFK-281) UBER DIE REAKTIONEN DER ELEMENTE NEPTUNIUM, PLUTONIUM UND AMERICIUM MIT 8-HYDROXYCHINOLIN UND EINIGEN SEINER DERIVATE. (On the Reactions of the Elements Neptunium, Plutonium, and Americium with 8-Hydroxyquinoline and Some Derivatives). Siegfried Helmut Eberle (Kernforschungszentrum, Karlsruhe (West Germany). Institut für Radiochemie). Jan. 1965. 92p. Dep.(mn).

The reactions of all valence stages of Np, Pu, and Am with chelating agents such as 8-quinolinol and its derivatives were investigated. Chelates of Pu(III), Am(III), Np(IV), Pu(IV), Np(V), and Pu(V) were prepared and their properties were determined. Np(VI) and Pu(VI) were reduced to the 5-valent stage by 8-quinolinol derivatives. (J.S.R.)

28288 (LADC-6439) MONTE CARLO EXPERIMENTS IN GAS KINETICS. Don L. Bunker (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [nd]. Contract [W-7405-eng-36]. 21p. Dep.(mn), $1.00(cy), 1(mn) CFSTI.

Two applications of the Monte Carlo technique to problems of gas kinetics are described. The partition of product energy in the reaction A + BC → AB + C + energy was studied, using the digital computer STRETCH; the procedure was tested by imitation of the reaction K + CH_3I → KI + CH_3, and resulting energy and angular distributions agreed very well with experimental results. The rate of the unimolecular reaction ABC + energy → AB + C was studied, computing lifetimes of energized triatomic molecules to test the validity of the random lifetime assumption. (M.J.T.)

28289 (NRL-6213) HIGH TEMPERATURE PROPERTIES OF SODIUM, POTASSIUM, AND CESIUM. Progress Report No. 13. J. P. Stone, C. T. Ewing, J. R. Spann, and R. R. Miller (Naval Research Lab., Washington, D. C.). Nov. 3, 1964. 5p. (AD-612096). $1.00(CFSTI).

The density of liquid potassium at 1099 to 2287°F and the vapor pressure of cesium at 1214 to 2345°F are reported. (W.L.G.)

28290 (UCRL-12260-T) THE VAPOR PRESSURE OF TECHNETIUM. Oscar H. Krikorian, John H. Carpenter, and Ray S. Newbury (Lawrence Radiation Lab., Univ. of California, Livermore). Dec. 14, 1964. Contract W-7405-eng-48. 7p. (CONF-650401-3) Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From American Chemical Society, Detroit.

In attempting to predict the enthalpy of sublimation of technetium, the periodic behavior of the enthalpies of sublimation of the transition elements was considered. The results indicate that the technetium value is even somewhat higher than that for molybdenum or ruthenium. This high value is not readily predictable from the periodic behavior of the enthalpies of sublimation. Moreover the high enthalpy value would not be expected from melting point behavior in this region of the periodic table. The melting point of technetium (2170°C) is lower than either that of molybdenum (2617°C) or ruthenium (2300°C). The vapor pressure of technetium was determined mass spectrometrically by comparing the intensities of Tc^+ and Mo^+. In similar experiments comparisons were made between molybdenum and niobium, and among molybdenum, niobium, and ruthenium. The comparative method has the advantage of cancelling many errors. It should provide accurate relative vapor pressures since all of the elements considered here have about the same appearance potentials, ionization efficiency curves, cross sections for ionization, and masses. The mass spectrometer provides a convenient tool for this study since the vapor pressure of technetium is quite low up to the melting point (about 10^{-7} atm.), and requires a sensitive detection method. Any investigation of the vapor pressure of technetium must be carried out in any oxygen-free environment. Estimated data show that the volatility of TcO approaches that of Tc at 2000°K if the oxygen pressure is greater than about 10^{-10} atm. (P.C.H.)

28291 (WCAP-3269-51) THE CALCULATED pH OF AQUEOUS BORIC ACID SOLUTIONS AS A FUNCTION OF TEMPERATURE AND ADDED BASE CONTENT. M. E. Meek (Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.). Mar. 1965. Contract AT(30-1)-3269. 33p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

Calculations of pH of chemical shim solutions at various temperatures are made using the equilibrium equations, the equations for conservation of total boron, charge, and total base. The pH is plotted as a function of total boron concentration and concentration of total base ion, and as a function of the total base (lithium or ammonia) and total boron concentration. Crossplots of pH versus total boron concentration at constant base concentration are presented. Plots of pH versus temperature at constant base and boron concentration are also presented. A method is described for an iterative graphical solution for the pH of a solution of boron and a neutralizing mixture of bases at constant temperature. (auth)

28292 THERMAL DIFFUSION IN BINARY MIXTURES OF NEON ISOTOPES AND METHANE: DIFFERENCES IN THE BEHAVIOR OF THE MOLECULES $^{12}CH_3D$ AND CH_4 AGAINST ^{20}Ne AND ^{22}Ne. Klaus Clusius and Manuel Quintanilla (Universidad, Zurich and Universidad, Saragossa, Spain). Anales Real Soc. Espan. Fis. Quim. (Madrid), Ser. A, 40: 159-66(July-Aug. 1964). (In Spanish)

Determination of thermal diffusion factors (α_{12}) of ^{20}Ne and ^{22}Ne against $^{12}CH_3D$, $^{13}CH_4$, $^{12}CH_4$ and $^{12}CD_4$ at different concentrations was carried out, using a Clusius-Dickel column. $^{13}CH_4$ was found to behave as a species heavier than $^{12}CH_3D$ whereas the usefulness of $^{12}CD_4$ as a filter gas was inferred. The results can not possibly be explained on a quantitative basis with (6, 12) Lennard-Jones model and Kihara's approximation for α. Nevertheless, a quantitative explanation is offered for the systems $^{20}Ne/^{12}CH_4$, $^{20}Ne/^{13}CH_4$, $^{22}Ne/^{12}CH_4$ and $Ne/^{13}CH_4$, and a

qualitative explanation is given for the other systems. (auth)

28293 ISONITRILOCYCLOPENTADIENYL COMPLEXES OF LANTHANIDES. E. O. Fischer and Hartmut Fischer (Anorganisch-Chemisches Laboratorium, Munich). Angew. Chem. Intern. Ed. Engl., 4: 246(Mar. 1965).

The reaction of tricyclopentadienyl compounds of lanthanides with cyclohexyl isonitrile at 20°C in benzene leads to novel complexes of formula $M(C_5H_5)_3CNC_6H_{11}$. These are the first compounds in which isonitriles are linked to rare-earth metals and in which a stable metal-carbon σ-bond is formed with such metals. So far, it was possible to isolate green $Yb(C_5H_5)_3CNC_6H_{11}$, mp 167°C; yellow $Ho(C_5H_5)_3CNC_6H_{11}$, 165°C; and colorless $Tb(C_5H_5)_3CNC_6H_{11}$, mp 162°C in analytical purity. The crystalline substances can be sublimed in vacuo and dissolve well in benzene and ethers, but are only slightly soluble in pentane and hexane. They are thermally stable and decompose only above 240°C. The action of oxygen and water results in rapid decomposition. The infrared spectra (recorded in Numol/Hostaflon mulls) of the three compounds are very similar, and show, as expected, one sharp ν_{CN} band at 2205 cm^{-1} (the ν_{CN} band of the free ligand lies at 2130 cm^{-1}). Further bands occur at 3077, 1449, 1014, and 787/759 cm^{-1}, and have been assigned to ν_{CH}, ω_{CC}, δ_{CH}, and γ_{CH} vibrations of the symmetrical five-membered ring. All three compounds are paramagnetic; their magnetic moments were measured by the susceptibility method in benzene using NMR methods. The values obtained for μ_{eff} were 4.5, 10.6, and 10.1 B.M. for these three compounds, respectively. (BBB)

28294 ROTATIONAL ANALYSIS OF VIOLET BANDS OF NiH AND NiD. Nils Aslund, Hinrek Neuhaus, Albin Lagerqvist, and Evert Andersen (Univ. of Stockholm). Arkiv Fysik, 28: 271-83(1964).

Spectra of NiH and NiD were taken in absorption through a King's furnace and photographed in a large concave grating spectrograph. Bands in the violet region of the spectrum, belonging to a $^2\Delta - {}^2\Delta$ transition were analyzed. $\Delta_{\frac{5}{2}} - \Delta_{\frac{5}{2}}$ sub-bands as well as $\Delta_{\frac{3}{2}} - \Delta_{\frac{3}{2}}$ sub-bands have been investigated for both molecules, for NiH also a $\Delta_{\frac{3}{2}} - \Delta_{\frac{5}{2}}$ band. The discovery of the latter sub-band made it possible to calculate the spin-coupling constants A′ and A″ for NiH. The upper $^2\Delta$ state as well as the lower $^2\Delta$ state are both inverted. For the 0-0 bands the following constants in cm^{-1} were derived: ν_0, ω_e, $\omega_e x_e$ and B. (auth)

28295 DETERMINATION OF THE PROPERTIES OF HEAVY WATER STEAM AT SATURATION BY CALCULATION. U. Issarescu (Gebruder Sulzer AG, Winterthur, Switzerland). Atompraxis, 11: 198-200(Apr. 1965). (In German)

By applying the second law of thermodynamics to the Carnot cycle within the saturated vapor, an equation was established, which allows calculation of the heat of vaporization for each temperature, derived from a sole calorimetric measurement and the corresponding data for volume and pressure. In this way the steam table for heavy water could be completed with supplementary properties of heat of vaporization and volume. (auth)

28296 ATOMIC EMISSION SPECTROSCOPY. S. C. Baker (Newcastle Univ. Coll., Australia). Australian J. Sci., 26: 171-7(Dec. 1963).

This review considers emission spectroscopy in the optical region and certain aspects of wavelength measurement, spectral term analysis, hyperfine structure (hfs), and instrumentation. The present state of knowledge is represented by ~180 spectra, counting those of multiply ionized atoms as separate spectra. On this basis, since there are 102 chemical elements, the possible number of atomic spectra is 5253, so that only one-tenth have been analyzed so far. The spectra of the rare earths and for the actinides are almost unknown and in some instances not even the ground state is known. The spectra of the rare earths are very complex; each contains thousands of lines of fairly uniform intensities so it is difficult to recognize series even with high resolution. In astrophysics several thousands of spectral lines, of which nearly 500 are strong, have been recorded but never identified with any of the known terrestrial spectra. It is likely that many of these belong to the rare earths. By 1946 optical hfs work had yielded the mechanical moments of 90 atomic nuclei, the magnetic moments of 70, and the electric quadrupole moments of 20. Values for many of the nuclides now available as enriched or separated isotopes have been and are being added to the list, which is now counted in hundreds. The isotope shift for light elements is due to the effect of nuclear mass on the Rydberg constant, but for the heavy elements it has been attributed to nuclear volume effects. Recent studies on the displacement effect on U isotope assay by d-c arc excitation of the oxides and photographic recording with a high resolution instrument are discussed. A survey of instrumentation reveals that a wide range of fine prism spectrographs is available today, but because of the scarcity of raw materials and the limited apertures practicable, diffraction gratings will probably be used more and more in the future, particularly where high resolution and low light intensities are concerned. Some studies are reviewed in which it was found that when a d-c arc is run between Fe electrodes at low currents, many of the second positive bands of the N molecule occur with great clarity among the Fe lines in two narrow regions in front of the anode. An explanation is offered for this phenomenon. (BBB)

28297 STRUCTURE OF JACHIMOVITE, $CuH_2(UO_2 \cdot SiO_4)_2 \cdot 5H_2O$. J. Piret-Meunier and M. van Meerssche (Université, Louvain, Belg.). Bull. Classe Sci. Acad. Roy. Belg., 49: 181-91(1963). (In French)

Jachimovite, or cuprosklodowskite, is found in Katanga at Kambove and Kalongwe in association with kasolite, sklodowskite, and vandenbrandeite, and at Luiswishi with vandenbrandeite; in Bohemia; in Saskatchewan; and in Morocco. It is a hydrated copper uranyl silicate, $CuO \cdot (UO_3)_2 \cdot (SiO_2)_2 \cdot 6H_2O$, crystallizing in emerald needles elongated along (100), with two crystals in the needle. The needles were studied by mounting on their maximum axis and irradiating with CuKα radiation filtered by Ni. Reflections of the Okl and lkl planes were recorded by the method of superposed films of Robertson. Jachimovite was shown to belong to the triclinic system; its unit cell is known to have the following dimensions: a = 7.04 Å, b = 9.18 Å, c = 6.66 Å, $\alpha = 109°14'$, $\beta = 90°00'$, $\gamma = 108°22'$, with one formula unit per unit cell, and space group $P\bar{1}$. Interpretation of the Patterson function, followed by normal Fourier syntheses and syntheses of differences reveals a structure of sheets. Indefinite anions of the formula $(UO_2SiO_4)_\infty^{2n-}$ parallel to (010) alternate with Cu cations and water molecules. The sheet has alternating UO_2 and SiO_4 groups; U has a coordination number of seven; Si is tetrahedral. Most of the anion atoms are in this plane; those of U and one of the silicate leave it. The Cu is equidistant from two sheets and holds them together; its nearest neighbors (two 0 from UO_2, four from water) form a distorted octahedron. The water oxygens form a square parallel to (100) and the others are at an angle of 75°. (BBB)

28298 PREPARATION OF THE GASEOUS MIXTURES $CO-CO_2$ AND O_2-N_2 WITH VERY LOW CONTENT IN CO OR O_2, AND THEIR UTILIZATION IN THE THERMODYNAMIC STUDY OF THE OXIDES OF URANIUM. Alain Kotlar and Paul Gerdanian (Faculté des Sciences, Orsay, France). Bull. Soc. Chim. France, No. 3, 628-32(Mar. 1965). (In French)

A technique for the continuous preparation of the gaseous mixtures $CO-CO_2$ and O_2-N_2 with very low contents of CO or O_2, of the order of 10 ppm, is described. The first results obtained with the aid of these gaseous mixtures in the thermodynamic study of non-stoichiometric oxides of uranium at 1094°C and for the composition interval $2.20 < O/U < 2.25$ are reported. (tr-auth)

28299 EFFECT OF GAS PHASE ON GRAPHITIZATION OF CARBON. Tokiti Noda and Michio Inagaki (Nagoya Univ., Japan). Carbon, 2: 127-30(Oct. 1964).

The degree of graphitization of carbon is generally considered to depend chiefly on the highest temperature of heat treatment and only slightly on the other conditions of heat treatment. It was found, however, that an ambient gas phase had a relatively large effect on graphitization of carbon. A petroleum coke and a carbon black were heat-treated at various temperatures in air, nitrogen, argon, and carbon dioxide. The lattice constant c_0 and the crystallite size L_c were determined by means of x ray diffraction. The experiments showed that the degree of graphitization of carbon depends not only on the highest temperature but also on the kind of ambient gas phase during the heat treatment. Oxygen in the ambient gas phase seemed to accelerate the graphitization and carbon dioxide had a similar but lesser effect, while no noticeable influence was detected in case of nitrogen and argon. (auth)

28300 OBSERVATIONS ON RESIDUES FROM LAMELLAR REACTIONS OF GRAPHITE. J. G. Hooley (Univ. of British Columbia, Vancouver). Carbon, 2: 131-4(Oct. 1964).

The residual bromine held in graphite at zero bromine pressure decreased with the rate of pressure reduction after prior bromination. The amount, however, cannot be reduced below a certain minimum. The amount in excess of this minimum can be removed at 450°C and is believed to be trapped by collapsing layers during the pressure reduction. Graphite containing its maximum residue of CrO_2Cl_2 does not intercalate Br_2 but does intercalate half the amount of ICl taken up by pure graphite. (auth)

28301 THE MECHANISM OF THE BROMINATION OF GRAPHITE. J. G. Hooley and J. L. Smee (Univ. of British Columbia, Vancouver). Carbon, 2: 135-8(Oct. 1964).

The rate of intercalation of graphite by bromine was measured for natural crystals over a range of 500 fold in area and 10 fold in thickness. The results were interpreted in terms of Fick's Law for radial diffusion in a cylinder and a mechanism in which all layers are open to intercalation as soon as bromine is admitted at high relative pressure. (auth)

28302 REACTION OF CARBON WITH OXIDIZING GASES: CATALYSIS BY COMPOUNDS OF IRON, COBALT, AND NICKEL. J. T. Gallagher and H. Harker (Univ. of Newcastle upon Tyne, Eng.). Carbon 2: 163-73(Oct. 1964).

An investigation was made on the effects of a series of iron, cobalt, and nickel compounds on the reactivity of a cellulose char. In order to make a preliminary survey of impurity effects in the carbon–oxygen reaction, the ignition temperature technique was used. The results suggested that the transition metal compounds function as true oxidation catalysts. In accord with this idea, these impurities were observed to be without effect on the thermal stability of surface oxide in the temperature range from 300 to 550°C. The influence of the impurities in the carbon–carbon dioxide reaction at higher temperatures (700 to 900°C) was also examined. The mechanism of catalysis was presumably different in this case, for it appeared to depend on the liberation of free metal. It is believed that metal atoms become incorporated into the carbon structure to produce a complex of higher reactivity. (auth)

28303 A STUDY OF THE AMPLITUDE OF VIBRATION OF CARBON ATOMS IN THE GRAPHITE STRUCTURE. E. A. Kellett, B. P. Jackets, and B. P. Richards (General Electric Co. Ltd., Wembley, Eng.). Carbon, 2: 175-83 (Oct. 1964).

The changes with temperature in the integrated intensity of the 0004 and 0006 reflections from graphite specimens were measured by means of an x ray counter diffractometer, using a high-temperature attachment developed originally for thermal expansion studies. Three varieties of graphite were examined, a spectroscopic material of $p \simeq 0.2$, a pyrolytic carbon of $p \simeq 0.1$, and a pyrolytic carbon $p \simeq 0.8$. The range of temperature between 1200 and 2500°C was covered. Values of the amplitude of vibration of carbon atoms normal to the layer planes were derived from the intensity measurements and a room temperature value of 0.099 Å was assumed. Tables and graphical representations of the results are presented. It is shown that the amplitude of vibration increases continuously with temperature for all the samples in the temperature range considered and at elevated temperatures the amplitude increases nearly as rapidly as the interlayer spacing; hence the mean "free space" between the layer planes decreases as temperature increases. The degree to which atomic movement was hindered in the graphite structure was a function of stacking disorder and not of the degree of preferred orientation of the graphite. (auth)

28304 FORMATION OF COMPLEXES: BEGINNING WITH URANIUM PENTAFLUORIDE AND SILVER MONOFLUORIDE. Roland Bougon and Pierre Plurien (Commissariat à l'Énergie Atomique, Gif-sur-Yvette, France). Compt. Rend., 260: 4217-18(Apr. 12, 1965). (In French)

By reaction of silver monofluoride with uranium pentafluoride in anhydrous medium, it was possible to identify new crystalline phases for the reaction products. These corresponded to the total formulas $AgUF_6$ and Ag_3UF_8. Other new crystalline phases were observed when thallium monofluoride replaced silver monofluoride in the same type of reaction. (tr-auth)

28305 SYNTHESIS AND SOME PROPERTIES OF SCANDIUM PERRHENATES. L. N. Komissarova, M. B. Varfolomeev, V. I. Ivanov, and V. E. Plyushchev (Moscow State Univ.). Dokl. Akad. Nauk SSSR, 160: 608-11 (Jan. 21, 1965). (In Russian)

Both the crystallohydrates and the anhydrous compound with the formula $Sc(ReO_4)_3$ were prepared from Sc_2O_3 and NH_4ReO_4 with the addition of $HReO_4$ (from metallic Re and nitric acid). Dissolution of the scandium oxide proceeded slowly with heat in the presence of hydrogen peroxide. An excess of Sc_2O_3 afforded a rapid and complete reaction at an optimal pH of 4.5. Crystallization of the solution from which the Sc_2O_3 excess had been filtered off occurred at 22-25°C. The process is described in detail. The products obtained, $Sc(ReO_4)_3 \cdot 3H_2O$, $Sc(ReO_4)_3 \cdot H_2O$, and $Sc(ReO_4)_3$, were studied. The trihydrate, crystallizing in prisms at 25°C, dissolves readily in water. Its crystals, viewed under x ray, have a triclinal primitive cell. At 50°C the trihydrate loses 2 molecules of water and turns into a monohydrate, stable up to 140°C, after which it becomes anhydrous. The anhydrous form is stable up to 550°C. At higher temperatures, it slowly dissociates into Sc_2O_3 and R_2O_7. Thermographic and thermogravimetric studies agreed satisfactorily with the data on isothermal dehydration. Results of diffraction studies are also reported. The anhydrous perrhenate is highly hygroscopic and rapidly changes into the monohydrate in air. (ATD)

28306 ELECTROLYTIC PROCESS FOR SINGLE-STAGE REDUCTION OF NIOBIUM(V) TO NIOBIUM (IV). M. Lardon (Eidgenossische Technische Hochschule, Zurich) and Hs. H. Guenthard. Helv. Chim. Acta, 48: 565-6(1965). (In German)

A method was developed for preparation of solutions of Nb(IV) by electrolytic reduction of Nb(V). Limits for increasing the Nb(IV) concentration are discussed. (M.C.G.)

28307 ON A SIMPLIFICATION OF THE DESCRIPTION AND ANALYSIS OF COMPLEX NUCLEAR MAGNETIC RESONANCE SPECTRA WITH THE HELP OF PARTIAL SPECTRA. P. Diehl (Universität, Basel). Helv. Chim. Acta, 48: 567-80(1965). (In German)

Principles of subspectral analysis are described, and the method of subspectral transformations is introduced. Subspectral transformations transform parts of the Hamiltonian of complex nmr (nuclear magnetic resonance) problems into the Hamiltonian of simpler subproblems. The method was applied to spectra of the type AA′XX′, AA′A″A‴XX′, AA′A″XX′X″, and ABB′XX′, which are shown to be superpositions of simple and well-known subspectra. (auth)

28308 THE HEAT OF FORMATION OF XENON TETROXIDE. Stuart R. Gunn (Univ. of California, Livermore). J. Am. Chem. Soc., 87: 2290-1(May 20, 1965).

The heat of explosive decomposition of the XeO_4 gas to its constituent elements at 25°C was measured. The oxygen and xenon obtained were analyzed mass spectrometrically. The heat of formation of XeO_4(g) was calculated to be 153.5 kcal/mole. Results indicated that XeO_3 was either not formed in the decomposition or that any produced was subsequently decomposed to the elements. The thermochemical bond energy of XeO_4 was calculated to be 21.1 kcal. Heats of formation of xenon oxyfluorides were estimated from these values. (M.C.G.)

28309 ION-ION INTERACTIONS IN RARE-EARTH DOPED LaF_3. M. R. Brown (Signals Research and Development Establishment, Christchurch, Hampshire, Eng.), J. S. S. Whiting, and W. A. Shand. J. Chem. Phys., 43: 1-9(July 1, 1965).

A systematic study was made of quantum efficiencies and lifetimes of the visible fluorescences of Pr^{3+} in single-crystal LaF_3. An analysis of the results as a function of Pr^{3+} concentration is given in terms of a two-site model in which a Pr^{3+} ion can either be in an isolated site or in a site where it is coupled to other impurity ions. This model leads to ion–ion interaction ranges varying from ~5 Å (nearest neighbor) to ~12 Å depending on the fluorescent level studied. Throughout this range of interaction lengths, Dexter's model of electrostatic ion–ion interaction showed that the dominant contribution comes from the quadrupole–quadrupole term. Temperature effects in the interaction were consistent with the lack of exact resonance between the electronic levels. It appeared that the lattice can readily absorb excess energy up to ~1000 cm^{-1}. A set of samples doped with a second rare earth (Ce^{3+}, Nd^{3+}, Eu^{3+}, Gd^{3+}, Tb^{3+}, Dy^{3+}, Ho^{3+}, Er^{3+}, Tm^{3+}, Yb^{3+}) demonstrated the existence of selection rules for ion–ion interaction in addition to energy-matching requirements. The system 0.5% Pr^{3+} : x% Ce^{3+} was studied in more detail. (auth)

28310 ON THE RADIAL DEPENDENCE OF THE FLUORESCENCE-QUENCHING INTERACTION BETWEEN RARE-EARTH IONS. W. W. Holloway, Jr., and M. Kestigian (Sperry Rand Research Center, Sudbury, Mass.). J. Chem. Phys., 43: 147-9(July 1, 1965).

The radial dependence of the quenching interaction between rare earth ions was studied through observation of the Tb^{3+} fluorescence lifetime in samples of $Gd_{1-2c}Tb_cHo_cCl_3 \cdot 6H_2O$. The probability for a quenching interaction, P_{Int}, was determined to be $P_{Int} \propto c^2 \propto 1/r^6$. On the basis of the "resonance" transfer of energy, such a radial dependence implied a dipole–dipole interaction. Other experiments are discussed in which identical results were obtained. (auth)

28311 THERMODYNAMIC PROPERTIES OF THE CESIUM-GRAPHITE LAMELLAR COMPOUNDS. F. J. Salzano and S. Aronson (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys., 43: 149-54(July 1, 1965). (BNL-8777)

The vapor pressures of the cesium–graphite lamellar compounds in the two-phase regions were measured at temperatures of 400 to 750°C. The Knudsen effusion method, in conjunction with a tracer technique employing ^{134}Cs, was used. Thermodynamic properties were calculated from the data and are discussed in relation to the structures of the cesium–graphite lamellar compounds. (auth)

28312 PHOTOLUMINESCENT PROPERTIES OF SOME EUROPIUM-ACTIVATED GADOLINIUM AND YTTRIUM COMPOUNDS. A. Bril, W. L. Wanmaker, and J. Broos (Philips' Gloeilampenfabrieken, N. V., Eindhoven, Netherlands). J. Chem. Phys., 43: 311(July 1, 1965).

Some photoluminescent properties of europium-activated oxides and orthovanadates of gadolinium and yttrium are described. The spectral energy distribution is shown for 254-nm excitation at room temperature and 77°K. The quantum efficiencies for 250- to 270-nm excitation were high (65 to 70%). (M.C.G.)

28313 KINETIC STUDIES OF THE OXIDATION OF IODINE WITH CERIC SULFATE. (L). Kuan Pan and Schoen-Nan Chen (National Taiwan Univ., Taipei). J. Chinese Chem. Soc. (Taiwan), 11: 71-83(June 1964).

A spectrophotometric study was made of the oxidation of iodine by ceric sulfate in sulfuric acid solution. Ceric sulfate was chosen as the oxidant because the mechanism of the reactions between Ce ion and some molecular reactants proceed at measurable rates. If iodine is oxidized to hypoiodite, iodite, or iodate, the mole ratio of reactants, ceric ion to iodine which disappear is 2 : 1, 6 : 1, and 10 : 1, respectively. Since the mole ratio actually found was about 5 : 1 from spectrophotometric measurements, hypoiodous and iodic ions may be produced in appreciable amounts in the course of the oxidation-reduction reaction. Thus if iodite can be assumed to be very unstable, iodate may be the main final product of oxidation. Since the production of iodate was confirmed by polarographic analysis, a consecutive reaction of the following steps, $I_2 \rightarrow HIO \rightarrow (HIO_2) \rightarrow HIO_3$, was expected. A solution containing 2.0×10^{-4} M iodine and 0.02 M ceric sulfate in 1.0 M H_2SO_4 was polarographically analyzed, confirming the production of iodate. The oxidation of iodine by ceric ion was found to be second order with respect to iodine and first order with respect to Ce(IV), by spectrophotometric measurements. $CeSO_4^{+2}$ was assumed to be the active species of ceric sulfate. The over-all rate constants were found to be $k_0 = 2.66 \times 10^4$ $l^2/M^2 \cdot$ min for the reaction rate, $-d[I_2]/dt = k_0$ [Ce(IV)] $[I_2]^2$ in 1.0 M H_2SO_4 and $k'' = 1.12 \times 10^5$ $l^2/M^2 \cdot$ min for the reaction rate, $-d[I_2]/dt = k''$ $[CeSO_4^{+2}]$ $[I_2]^2$. (BBB)

28314 CHROMIUM FLUORESCENCE IN THE $LaAlO_3$–$LaGaO_3$ SYSTEM. R. Mazelsky and R. Ohlmann (Westinghouse Electric Corp., Pittsburgh). J. Electrochem. Soc., 112: 626-7(June 1965).

The fluorescence of chromium ions in $LaAlO_3$, $LaGaO_3$, and in solid solutions of the two is reported with emphasis on the variation of fluorescence as the Al/Ga ratio changed. Chromium showed a strong preference for the Al or Ga site. The 24 cm^{-1} splitting of the R lines in $LaGaO_3$ compared to 5.4 cm^{-1} in $LaAlO_3$ was concluded to be due to the greater distortion of the Cr^{3+} site from octahedral symmetry in $LaGaO_3$ compared to $LaAlO_3$. The broad line widths of the fluorescence observed from the solid solutions was considered likely to be an inhomogeneous broadening arising from the individual Cr^{3+} ions being in somewhat different surroundings from each other. (M.C.G.)

28315 HEXAVALENT FLUORIDES OF TANTALUM AND NIOBIUM. G. W. Mellors and S. Senderoff (Union Carbide Corp., Parma, Ohio). J. Electrochem. Soc., 112: 642-3(June 1965).

It was found that hexavalent compounds of tantalum and niobium can be prepared by the electrolysis of solutions of the pentavalent tantalum and niobium fluorides dissolved in molten alkali fluorides with any suitable conducting cathode and an inert anode. The valence state was established by chronopotentiometry. (M.C.G.)

28316 COMPOSITION OF THE URANIUM–CHROMOTROPIC ACID SALT CHELATE BY ABSORPTIOMETRIC MEASUREMENTS. Satendra P. Sangal (Univ. of Allahabad, India). J. Prakt. Chem., 26: 137-9(1964).

The composition of the yellowish-red chelate of uranium with chromotropic acid salt was established by the method of continuous variations using absorbance data. The composition was confirmed by the mole ratio method and the slope ratio method using spectrophotometric measurements. The results of the two methods show that the ratio of U to chromotropic acid salt is 1 : 1, as obtained previously by the continuous variation technique. (TCO)

28317 STUDIES ON THE FORMATION OF COMPLEX COMPOUNDS BETWEEN TRANSITION METAL NITRATES AND URANYL NITRATE. THE SYSTEM: $Ni(NO_3)_2$–$UO_2(NO_3)_2$–H_2O (CONDUCTANCE, pH, SPECTROPHOTOMETRY, AND REFRACTIVE-INDEX). S. S. Gupta and S. D. Marwah (Lucknow Univ., India). J. Prakt. Chem., 26: 225-32(1964).

A series of 22 aqueous solutions was made in which the concentration of uranyl nitrate remained the same (0.01M), while that of nickel nitrate varied systematically from 0 to 0.042M. The ratio of the constituents so obtained varied from 5/0 to 5/21 for $UO_2(NO_3)_2/Ni(NO_3)_2$. The series of 22 mixed solutions was prepared by following the monovariation method. Results of measurement of conductance, pH, spectrophotometry, and refractive index measurements on these solutions indicated the presence of two definite complex compounds in solution namely $Ni(NO_3)_2 \cdot UO_2(NO_3)_2$ and $3Ni(NO_3)_2 \cdot UO_2(NO_3)$. When these values were plotted against the varying concentrations of nickel nitrate, two breaks were obtained in the regular curves at concentrations corresponding to the compounds having these formulas. (BBB)

28318 STUDIES ON THE FORMATION OF COMPLEX COMPOUNDS BETWEEN TRANSITION METAL NITRATES AND URANYL NITRATE. THE SYSTEM: $Fe(NO_3)_3 - UO_2(NO_3)_2 - H_2O$ (CONDUCTANCE, pH, SPECTROPHOTOMETRY, AND REFRACTIVE-INDEX). S. S. Gupta and S. D. Marwah (Lucknow Univ., India). J. Prakt. Chem., 26: 272-8(1964).

Measurements of conductance, pH, spectrophotometry, and refractive index of a series of mixed solutions of uranyl nitrate and ferric nitrate indicate the existence of two definite complex-compounds in solution, namely $Fe(NO_3)_3 \cdot UO_2(NO_3)_2$ and $2\,Fe(NO_3)_3 \cdot UO_2(NO_3)_2$. The monovariation method was used in the preparation of the solutions of uranyl nitrate and ferric nitrate. The concentration of uranyl nitrate was kept constant while that of ferric nitrate was varied systematically, and the physicochemical properties measured. When the values were plotted against the concentration of ferric nitrate, curves are obtained with two specific breaks. The kinks occur at exact stoichiometric ratios of concentrations corresponding to the compounds the formulas of which are given. All four parameters measured yielded identical evidence for the ratios corresponding to these compounds. (BBB)

28319 RARE-EARTH IONS IN THE ALKALI HALIDES. II. PSEUDOLOCALIZED VIBRATIONAL FREQUENCIES. Max Wagner and W. E. Bron (International Business Machines Corp., Yorktown Heights, N. Y.). Phys. Rev., 139: A223-33(July 5, 1965).

Vibronic structure observed in the emission and absorption spectra of alkali halides containing either Sm^{2+}, Eu^{2+}, or Yb^{2+} is reported, and shown to result from pseudolocalized vibrations occurring at the rare-earth defect. A model for the defect is defined, and an analysis of its vibrational frequencies is given for the sample case of a RbCl host lattice. A Green's function formalism is used in the analysis. The calculation, in which a number of approximations are made, yields the qualitative features of the experimental results. (auth)

28320 RARE-EARTH IONS IN THE ALKALI HALIDES. III. ELECTRON-LATTICE COUPLING AND THE DETAILS OF THE VIBRONIC SPECTRA. W. E. Bron and Max Wagner (International Business Machines Corp., Yorktown Heights, N. Y.). Phys. Rev., 139: A233-41(July 5, 1965).

Electron-lattice interaction is discussed for the case of rare-earth ions in the alkali halides. A selection rule is derived to show that for the present defect electronic transitions can be coupled only to vibrational modes of A_1 symmetry. Under the assumption of electrostatic coupling between the electron and the lattice vibrations, a coupling function is derived which is proportional to the projection of the field of the electron undergoing a transition on to the eigenvectors of the vibrations. It is further shown that this coupling function can be determined from the details of the structural form of the vibronic spectra. A number of other features of the vibronic spectra are accounted for through the properties of Franck-Condon integrals. (auth)

28321 MÖSSBAUER FRACTIONS AND SPECIFIC HEATS OF DIATOMIC LATTICES. Y. Disatnik, D. Fainstein, and H. J. Lipkin (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev., 139: A292-4(July 5, 1965).

A simplified analysis using one-parameter models (like the Debye model for monatomic lattices) without details of the normal-mode spectrum (acoustic, optic) is proposed and applied to the alkali iodides. The theoretical basis is the insensitivity of $\langle x^2 \rangle$ and $\langle p^2 \rangle$ of a given lattice atom to changes in masses of other lattice atoms. The calculations utilize simple relations between the Mössbauer fraction and the specific heat of an alkali iodide crystal and the corresponding properties of a fictitious monatomic iodine crystal where all the atoms have the iodine mass but the forces between atoms are those of the alkali iodide crystal. A Debye model for the fictitious crystal is used to fit experimental data. A good fit is obtained with one parameter, the Debye temperature of the fictitious crystal. (auth)

28322 ULTRASONIC PARAMAGNETIC-RESONANCE ABSORPTION BY URANIUM IONS IN CALCIUM FLUORIDE. G. C. Wetsel, Jr., and P. L. Donoho (Rice Univ., Houston, Tex.). Phys. Rev., 139: A334-7(July 5, 1965).

Ultrasonic paramagnetic-resonance absorption by uranium ions in CaF_2 was observed at an elastic-wave frequency of 9.4 Gc/sec and sample temperature of 1.5°K. The observed absorption was due only to U^{4+} ions in sites of trigonal symmetry; no absorption due to U^{3+} ions, which were also present, could be detected. The results indicate that U^{4+} can be treated by means of a spin-lattice hamiltonian of the same form as that used previously to successfully explain spin-lattice interactions for iron-group ions, and that the spin-lattice interaction for U^{4+} in CaF_2 is comparable in magnitude to that for iron-group ions in other crystals. (auth)

28323 THE CHEMISTRY OF THE NOBLE GASES. Sukumar Maiti (Indian Assn. for the Cultivation of Science, Calcutta). Sci. Cult. (Calcutta), 31: 108-19(Mar. 1965).

The history of the discovery of the rare gases and early attempts to prepare chemical compounds of them are discussed. Preparation of $XePtF_6$ and other fluorides of xenon is described. Preparation of xenon oxygen compounds, complex xenon compounds, krypton fluorides, radon fluorides, and helium fluorides is discussed. The nature of bonding in the rare gas compounds is considered, and the octahedral hybrid model, correlation effects model, molecular-orbital model, and valence-bond resonance model are described. (M.C.G.)

28324 REFLECTANCE SPECTRA OF TWO SOLVATED URANIUM 8-HYDROXYQUINOLATES. R. J. Magee and Louis Gordon (Case Inst. of Tech., Cleveland). Talanta, 12: 441-4(May 1965). (COO-582-4)

On precipitation of uranyl 8-hydroxyquinolate from homogeneous solution, two different chelates are obtained. $UO_2(C_9H_6NO)_2 \cdot C_9H_6NOH$ is dark red whereas $[UO_2(C_9H_6NO_2]_2 \cdot C_9H_6NOH$ is orange. On grinding, the dark-red chelate becomes orange. Reflectance spectra are used to explain the initial color difference as well as the change in color of the dark-red compound to orange on grinding. (auth)

28325 INFRARED SPECTRA OF CHELATE COMPOUNDS. [PART] IV. A STUDY OF THE URANYL CHELATES OF 8-HYDROXYQUINOLINE IN THE REGION 5000-250 cm^{-1}. R. J. Magee and Louis Gordon (Case Inst. of Tech., Cleveland). Talanta, 12: 445-50(May 1965). (COO-582-3)

Previous investigations showed that two different uranium chelates of 8-hydroxyquinoline can be precipitated from homogeneous solution. Dark red $UO_2(C_9H_6NO)_2 \cdot C_9H_6NOH$ is obtained at pH 5.0 and orange $[UO_2(C_9H_6NO)_2]_2 \cdot C_9H_6NOH$ at pH 6.8; the normal chelate $UO_2(C_9H_6NO)_2$ is green. The infrared spectra of the solvated compounds were examined in the range 5000 to 250 cm^{-1} and that of the normal chelate in the range 5000 to 650 cm^{-1}. From this it was concluded that the solvated chelates have very similar structures. (auth)

28326 THE CHEMISTRY OF HYDROGEN IN LIQUID ALKALI-METAL MIXTURES USEFUL AS NUCLEAR REACTOR COOLANTS. I. NaK-78. Edgar L. Compere and Jouko E. Savolainen (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 18(May 1965).

28327 AEROSOL CHARACTERISTICS OF BURNING SODIUM AND PLUTONIUM. Harry J. Ettinger, William D. Moss, and Harold M. Busey (Los Alamos Scientific Lab., N. Mex.). Trans. Am. Nucl. Soc., 8: 143(May 1965).

28328 METAL-DISTILLATION SURFACE MEASUREMENTS WITH AN X-RAY SPECTROMETER. William J. Walsh and George Burnet, Jr. (Iowa State Univ., Ames). Trans. Am. Nucl. Soc., 8: 174(May 1965).

28329 DETECTION OF PLUTONIUM PENETRATION THROUGH CONTAINERS AT HIGH TEMPERATURES. W. M. Moore, Dale M. Holm, H. Ruess, and R. L. Andelin (Los Alamos Scientific Lab., N. Mex.). Trans. Am. Nucl. Soc., 8: 174-5(May 1965).

28330 YVO_4:Eu—A NEW RED-EMITTING PHOSPHOR FOR COLOR TELEVISION. Albert K. Levine and Frank C. Palilla (General Telephone and Electronics Labs. Inc., Bayside, N. Y.). Trans. N. Y. Acad. Sci., 27: 517-29(May 1965).

A red-emitting phosphor, europium-activated yttrium vanadate, for use in color television is described. The principles of image transmission in color televisions and requirements for phosphors are discussed. The effects of spectral bandwidth on luminous efficiency are considered. YVO_4 is prepared by reacting the oxides or other oxygen-containing compounds of yttrium and vanadium at temperatures above 900°C. Europium readily substitutes for part of the yttrium during the synthesis to form the phosphor. The fluorescent emission from YVO_4:Eu is due to the 4f-4f transitions within the Eu^{3+} ion. YVO_4:Eu has the appearance of a pure spectral red, corresponding approximately to 612 nm, and the luminous output from the phosphor is linear with the electron current density. (M.C.G.)

28331 SHAPE OF THE RESONANCE ABSORPTION SPECTRA OF 23.8 kev γ-RAYS FROM Sn^{119m} IN TIN OXIDE AND IN METALLIC WHITE TIN. K. P. Mitrofanov, M. V. Plotnikova, and V. S. Shpinel (Moscow State Univ.). Zh. Eksperim. i Teor. Fiz., 48: 791-5(Mar. 1965). (In Russian)

The shape of the resonance absorption spectra of 23.8-kev γ-rays from the ^{119m}Sn isomer was investigated in tin oxide and metallic white tin with a $Mg_2{}^{119m}Sn$ source and a resonance counter. It is shown that the absorption spectrum in SnO_2 is a doublet with a splitting $\Delta = 0.50 \pm 0.02$ mm/sec; its magnitude does not depend on the temperature. In metallic tin the spectrum is a broad single line whose width decreases upon heating. If the β-Sn absorption spectrum is regarded as consisting of two lines of natural width, the behavior may be explained as being due to a change in the magnitude of splitting from 0.32 to 0.25 mm/sec when the temperature is changed from that of liquid nitrogen to room temperature. (auth)

28332 DIVALENT EUROPIUM SULFATE. Yu. S. Sklyarenko and N. S. Stroganova (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Moscow). Zh. Neorgan. Khim., 10: 647-52(Mar. 1965). (In Russian)

The composition of divalent europium sulfate $EuSO_4$ was confirmed with high precision. The stability of the compound was evaluated with respect to the oxidation system $EuSO_4-H_2O$ in air and in inert atmospheres. It was found that in nitrogen or argon atmospheres the system was stable, and in air it was gradually oxidized. The solubility of $EuSO_4$ in water was determined at 20 ± 1°C. It was 7.45×10^{-5} mol/l (0.0185 g/l), which was below the solubility of $Eu_2(SO_4)_3 \cdot 8H_2O$ by three orders of magnitude. (tr-auth)

28333 SOLUBILITY OF ThF_4 IN HF. Yu. A. Buslaev and M. P. Gustyakova (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). Zh. Neorgan. Khim., 10: 662-5(Mar. 1965). (In Russian)

The solubility of thorium tetrafluoride in solutions of HF at 25°C was investigated. In the system ThF_4-HF-H_2O the existence of three solid phases with the composition $ThF_4-0.7$ to $1.5H_2O$, ThF_4-HF-H_2O, and ThF_4-4HF was detected. (tr-auth)

28334 SYSTEM $Gd(NO_3)_3-NH_4NO_3-HNO_3-H_2O$. I. Z. Babievskaya and F. M. Perel'man (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). Zh. Neorgan. Khim., 10: 681-3(Mar. 1965). (In Russian)

Isotherms (25°C) were investigated in the system $Gd(NO_3)_3-NH_4NO_3-HNO_3-H_2O$ at ~33% HNO_3; the solubility and specific gravity were determined. It was found that in the system there were three solid phases: $Gd(NO_3)_3-4H_2O$, $Gd(NO_3)_3-2NH_4NO_3$, and NH_4NO_3. The composition of the liquid phase corresponding to the transition point, at which $Gd(NO_3)_3-4H_2O$ and $Gd(NO_3)_3-2NH_4NO_3$ crystallize, was 21.3% NH_4NO_3 and 39.5% $Gd(NO_3)_3$; but the composition of the solution corresponding to the eutectic point (the solid phases $Gd(NO_3)_3$, $2NH_4NO_3$, and NH_4NO_3) was 18.3% $Gd(NO_3)_3$ and 51.6% NH_4NO_3. (tr-auth)

28335 REACTIONS OF URANIUM DIOXIDE WITH NITROUS ACID IN SULFURIC ACID SOLUTIONS. A. P. Filippov, E. A. Kanevskii, and N. V. Timofeeva. Zh. Prikl. Khim., 38: 658-60(Mar. 1965). (In Russian)

It was shown that, at 20°C in H_2SO_4 solution, strong reactions of uranium dioxide with nitrous acid, carried out in the oxide solution, take place. Investigation of the gaseous products of the reaction showed that nitric oxide appeared as the fundamental product of the reduction of HNO_2. On the basis of the results of the analysis of the solution and gaseous phases it was established that the oxidation of the uranium dioxide with nitrous acid in a sulfuric acid medium proceeds by the equation: $UO_2 + 2HNO_2 + H_2SO_4 \rightarrow UO_2SO_4 + 2NO + H_2O$. (tr-auth)

28336 MASS DIFFERENCES OF DOUBLETS INVOLVING H, D, C, N, AND O. Koreichi Ogata and Satoru Matsumoto (Osaka Univ.). p.415-22 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

The mass differences of doublets involving C, H, D, N and O were determined using a Bainbridge-Jordan mass spectrograph. The results are presented, together with masses of D, ^{14}N, and ^{16}O calculated from the mass difference under the assumption that the mass of H is 1.00782522. (D.C.W.)

28337 THERMAL CONDUCTIVITY OF GASES AND LIQUIDS. N. V. Tsederberg. Translation by Scripta Technica. Cambridge, Mass., Massachusetts Institute of Technology, 1965. 258p. $12.50.

The thermal conductivity of gases, liquids, gas mixtures, and liquid solutions is covered. Existing theories, and equations proposed for calculation of thermal conductivity at low pressure are reviewed. The thermal conductivity of gases at high pressures, in the critical state and during transition to the liquid state, is discussed. Thermal conductivity equations for nonassociated and associated liquids at atmospheric pressure are cited. Empirical equations were derived for the thermal conductivity of solutions. The basic experimental techniques and theories underlying the experimental methods for determining thermal conductivities of liquids and gases are explained. An analysis of experimental corrections is presented and possible errors of measurement are indicated. Plasma at temperatures up to 13,000°K and pressures from 10^{-3} to 10^3 atm is also considered. (M.C.G.)

28338 FLUORINE GENERATING FACILITY (Engineering Materials). (Goodyear Atomic Corp., Portsmouth, Ohio). 7 drawings. (CAPE-1194)

Drawings (7) are presented for the 40-cell, 6000-amp plant, which is designed to produce 1.4 lb of fluorine per 1000 amp-hr with a total capacity of 115 tons per month at 90% efficiency. The plant consists of interconnected groups of electrolytic cells, arranged in banks. Each bank of cells is operated in electric series from large rectifiers and the outlet gas piping is tied to common headers. A continuous feed of hydrogen fluoride is metered, as a gas, to each individual cell. Electrolyte temperatures are controlled by variable water cooling. Outlet fluorine is purified by refrigeration to reduce the hydrogen fluoride content to less than 4%. (For details, see TID-4100.) (D.L.C.)

28339 OBSERVATION OF SUPERPARAMAGNETISM BY THE MÖSSBAUER EFFECT. W. J. Schuele (Franklin Institute, Philadelphia). S. Shtrikman, and D. Treves. 8p. (CONF-794-10)

From Magnetism Conference, Minneapolis, Nov. 1964.

Mössbauer spectra of ^{57}Fe in ultrafine $NiFe_2O_4$ and $CoFe_2O_4$ powders were studied as a function of crystallite size and temperature. The hyperfine field was found to collapse at a temperature lower than the Curie point which decreased with particle size. This collapse of the hyperfine field is interpreted as motional narrowing due to the onset of superparamagnetism. (auth)

28340 IMPROVEMENTS IN OR RELATING TO LIGHT SOURCES. David Graham Guthrie (to Sauders-Roe and Nuclear Enterprises Ltd.). British Patent 985,383. Mar. 10, 1965. Filed Sept. 8, 1962.

A method of phosphor coating the surface of radioactive isotope activated light sources includes lightly dusting the degreased surface with the phosphor, spreading orthophosphoric acid in solution upon the surface, evaporating the solvent, providing excess phosphor to adhere to the acid, and removing the surplus phosphor. The orthophosphoric acid is dissolved in diethyl ether. After removal of the excess phosphor, the glass light source is placed in an oven to convert the orthophosphoric acid to pyrophosphoric acid, which will fix the phosphor firmly in position on the inside of the glass bulb to yield a thin uniform layer of phosphor. (B.L.M.)

28341 A METHOD OF PREPARING URANIC OXIDE IN GRANULATED FORM. Jakub Burko, Alain Pigeot, Claude Jouannaud, and Patrick Georges Nollet (to Commissariat a l'Energie Atomique). British Patent 986,852. Mar. 24, 1965. Priority date June 5, 1961, France.

Granulated UO_3 may be prepared from concentrated aqueous uranyl nitrate or from a paste of ammonium uranate by adding fine particles of UO_3 of a grain size smaller than the size to be obtained, stirring to form an intimate mixture, and roasting the mixture at a temperature ranging from 170 to 250°C. The amount of UO_3 particles added to the solution or paste contains a weight of U ranging from 80 to 300%, preferably 200%, of the weight of U contained in the solution or paste. The added particles have a grain size ranging from 0.1 to 1 mm, and the fine particles may be obtained from the sifting of the product leaving the mixer and recycled to the inlet of the mixer. The grain size of the product is easily adjusted since it depends essentially upon the grain size of the fine particles mixed with the starting material. Nitric acid resulting from the thermal decomposition of the uranyl nitrate may be recovered. (B.L.M.)

28342 METHOD OF PREPARING URANIC OXIDE IN GRANULATED FORM. Jakub Burko, Alain Pigeot, Claude Jouannaud, and Patrick G. Nollet (to Commissariat à l'Énergie Atomique). Canadian Patent 675,512. Dec. 3, 1963. Priority date June 5, 1961, France.

A method is reported for the preparation of UO_3 in granulated form from either concentrated aqueous solutions of uranyl nitrate or ammonium uranate pastes. Fine particles of UO_3 (0.1 to 1 mm grain size) are added to the starting material heated to a temperature of 170 to 250°C in a mixer. The amount of UO_3 added to the starting material should contain a weight of U about twice that contained in the starting material. The mixture is roasted to a temperature ranging from 290 to 360°C. (B.L.M.)

28343 XENON TETRAFLUORIDE AND PROCESS OF MAKING SAME. Howard H. Claassen, Henry Selig, and John G. Malm (to U. S. Atomic Energy Commission). U. S. Patent 3,183,061. May 11, 1965.

A process of preparing xenon tetrafluoride by reacting xenon and fluorine at 350 to 450°C and cooling is described. The properties of XeF_4 are discussed. (AEC)

28344 PROCESS OF MAKING RADON FLUORIDE AND OF SEPARATING RARE GASES FROM EACH OTHER. Paul R. Fields, M. H. Zirin, and L. Stein (to U. S. Atomic Energy Commission). U. S. Patent 3,185,548. May 25, 1965.

This patent deals with a process of preparing radon fluoride by reacting fluorine gas of 300 to 800 mm Hg with radon at 400 to 500°C; with a process of separating noble gases using this process; and with the compound radon fluoride. (AEC)

Organic Chemistry

28345 (SC-DC-64-2060) ULTRASONIC MEASUREMENTS ON PLASTIC CRYSTALS NEAR THE SOLID-SOLID TRANSFORMATION POINTS. Carl. E. Scheie and John R. Green (New Mexico Univ., Albuquerque). Dec. 1964. Contract AT(29-1)-789. 8p. (CONF-641210-2). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From American Physical Society Meeting, Berkeley, Calif.

Measurements were made of the velocity of ultrasound in polycrystalline samples of cyclohexane, cyclohexanol, and camphene at temperatures above and below their respective transformation points. Transit times were used to measure the velocities. The polycrystalline nature of the solids provides numerous interfaces for the interconversion of the transverse and longitudinal propagation modes. The equations of motion in a cubic solid were solved, and in general there are two transverse modes and one longitudinal mode. The calculated ratios of the reciprocal transverse and reciprocal longitudinal velocities are plotted as functions of C_{44}/C_{11}, for each compound. (M.J.T.)

28346 (TID-21662) TRACER AND ISOTOPE EFFECT STUDIES IN ORGANIC CHEMISTRY. Annual Progress Report. Arthur Fry (Arkansas Univ., Fayetteville. Dept. of Chemistry). Jan. 15, 1965. Contract AT(40-1)-3234. 24p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Results of studies on acid-catalyzed ketone rearrangement mechanisms are presented. Information is included on acid-catalyzed rearrangement of 3,3-dimethyl-2-butanone-1-^{14}C and 3,3-dimethyl-2-butanone-2-^{14}C. Information is also included on disproportionation in acid-catalyzed rearrangements of aliphatic ketones, rearrangement of aliphatic ketones on supported acidic catalysts, rearrangement of propiophenone and related ketones, and rearrangement of ^{14}C-labeled phenyl benzyl ketone and phenyl benzhydryl ketone. Results of ^{18}O exchange studies on nitrobenzenes and benzopinacol are presented. The uses of isotope effect measurements in studies of organic reaction mechanisms are discussed, and data on Cl isotope effects in solvolysis of substituted benzoyl chlorides are included. (J.R.D.)

28347 THE H-D EXCHANGE BETWEEN DEUTERIUM GAS AND ALKYLBENZENES IN THE PRESENCE OF RANEY NICKEL. Leopold Horner and Dietmar Mayer (Universität, Mainz). Ann. Chem., 680: 1-11(1964). (In German)

Raney Ni was freed of H_2O by two techniques: azeotropic removal of H_2O with benzene followed by vacuum drying, or else direct removal of H_2O in vacuo. After 8 hours toluene had incorporated 1.520 atoms D/molecule; of this 80.7% was in the methyl group, 0.7% in the o, 11.4% in the m, and 7.2% in the p position. The rate processes for incorporation of D in the nucleus and side chain are different, and D content of the nucleus appears to increase at the expense of that of the side chain. Method of preparation of Raney Ni has little effect on the rates of hydrogenation or exchange; both are slightly increased by the second method of preparation. For the second method, percent incorporation of D after 8 hours in toluene and ethylbenzene are as follows: atoms D/molecule, 1.776, 1.770; side chain, 66%, 63%; o, 0.3%, 0.2%; m, 20.7%, 22.4%; p, 13.0%, 14.5%. The following results were obtained for 8-hour experiments with cumene, t-butylbenzene, o-xylene, m-xylene, p-xylene, and mesitylene: % hydrogenation: 6.3-8.2, 6.0-6.5, 2.5-3.5, 2.8-3.5, 4.3-5.3,

1.5; D atoms/molecule: 1.476-1.608, 1.225-1.316, 1.695-1.770, 1.750-1.770, 1.670-1.750, 1.674-1.788; % D in nucleus, 54.2-56.0, -, 9.5-10.2, 3.1-4.2, 0.7-2.4, 0.3-0.8. (BBB)

28348 ISOMERIZATION OF DEFINITELY DEUTERATED ALKYLBENZENES ON RANEY NICKEL. Leopold Horner and Dietmar Mayer (Universität, Mainz). Ann. Chem., 680: 11-20(1964). (In German)

Toluene deuterated in the methyl group was treated with about 40% of its weight of vacuum-dried Raney Ni for 16 hours. The D content of the toluene remained constant, so that there was no exchange with H bound on the Raney Ni. More than half (53.6%) of the D was found in the nucleus, and its distribution corresponded to the pattern found for the exchange of ordinary toluene with D_2 gas in the presence of Raney Ni (o, 8.2-11.9; m-, 28.3-29.2; p, 16.0-16.9). Less than 0.1% of the toluene was hydrogenated. Intermolecular D exchange was found by mass spectrometry. Ring-labeled toluenes were also examined; the o-deutero compound was found to have rearranged to 16.7% methyl, 66.3% o, 8.8% m, and 8.2% p. Likewise the m and p compounds had 47.1 and 47.3% methyl, 10.8 and 6.3% o, 29.4 and 29.5% m, and 12.7 and 16.9% p D. Beta-deuteroethylbenzene was found to have 39.0-39.8% D in the ring after the same treatment. Various mechanisms are discussed in light of the difference between the o position and the m and p position and in light of previous work in related areas. (BBB)

28349 LABELLING OF NUCLEOSIDES WITH TRITIUM. G. A. LePage and Irene G. Junga (Stanford Research Inst., Menlo Park, Calif.). Can. J. Chem., 43: 1279-81(May 1965).

The synthesis of 9-(α,β-D-2′-deoxyribofuranosyl)-2-amino-6-mercaptopurine with tritium labeling in both base and sugar was attempted. At the step where a mercury salt of the base and the blocked chlorosugar were coupled in benzene, the tritium labeling was lost, apparently by an exchange with the protons of the solvent. This appeared to be catalyzed by the mercuric chloride. It was demonstrated that unlabeled nucleoside could be labeled with tritium by refluxing it in benzene-T or toluene-T in the presence of mercuric chloride. By this exchange process, both base and sugar were tritiated, but a larger amount of tritium appeared in the base. Because of the availability of benzene-T and toluene-T of high specific radioactivity, this appeared to be a practical means of synthesis of the labeled nucleoside. (auth)

28350 MECHANISM OF ACTION OF UDPGal-4-EPIMERASE: ISOTOPE EFFECT STUDIES. Rardon D. Bevill, III, E. Alexander Hill, F. Smith, and S. Kirkwood (Univ. of Minnesota, Minneapolis). Can. J. Chem., 43: 1577-87(May 1965).

The synthesis of uridine diphosphate glucose and uridine diphosphate galactose labeled with tritium in the 4-position permitted the observation of the isotope effect associated with the UDPGal-4-epimerase reaction. This isotope effect was measured for the reaction proceeding in both directions and the values of k_T/k_H fell in the range from 1.5 to 3.0. This allowed certain conclusions to be drawn concerning the mechanism of this enzymatic catalysis. The direction and magnitude of the effect indicated that the 4-hydrogen is removed from the hexose in the course of the reaction. They also appeared to dispose of several mechanisms that were proposed for the epimerase. Specifically, mechanisms involving cleavage of the C–O or C–C bonds at carbon-4 of the hexose moiety, such as cleavage of the carbon chain, elimination and readdition of the carbon-4 hydroxyl as water, or ionization to form a carbonium ion, were not supported by the observed data. A mechanism consistent with all observations involved transfer of the hydrogen at carbon-4 to the enzyme in a step that was not rate determining. This was followed immediately by the rate-determining step, which may well be the reorganization of the enzyme–substrate complex to allow return of the hydrogen in the opposite configuration. The larger estimate of the isotope effect indicated a transfer of the carbon-4 hydrogen to a nitrogen atom located in the enzyme's structure; the smaller estimate was consistent with transfer to oxygen or carbon. Transfer to sulfur appeared to be definitely eliminated. A degradative procedure that will permit the location and quantitation of the carbon-bound tritium in any hexose or pentose was developed. (auth)

28351 SYNTHESIS OF ISOTOPICALLY LABELLED OLEFINS VIA THE WITTIG REACTION. J. G. Atkinson, M. H. Fisher, D. Horley, A. T. Morse, R. S. Stuart, and E. Synnes (Merck Sharp and Dohme of Canada, Ltd., Montreal). Can. J. Chem., 43: 1614-24(May 1965).

An application of the Wittig reaction to the preparation of olefins of low molecular weight, which allows selective labeling in the vinyl or allyl positions with isotopes of hydrogen and carbon, was developed. Using the modification of the Wittig reaction introduced by E. J. Corey, in which a solution of the methylsulfinyl carbanion in dimethyl sulfoxide serves as the base, a series of olefins from C_2 to C_8 were synthesized. The synthesis was applied to the preparation of the following labeled compounds: 5-methylene-^{14}C-bicyclo[2,2,1]hept-2-ene; propene-1-^{14}C; 1-butene-1-^{14}C; propene-1-d_1; 2-methylpropene-1,1-d_2; 2-methyl-d_3-propene-3,3,3-d_3; 2-methyl-2-butene-4,4,4-d_3; 2-methyl-d_3-2-butene-1,1,1-d_3; and methylene-d_2-cyclohexane. For the synthesis of carbon-labeled olefins the reaction has few limitations since the intermediates and products are isotopically stable under the reaction conditions. Deuterium-labeled olefins can be obtained from deuterated formaldehyde or β-deuterated phosphonium salts, but α-deuteroketones and aldehydes and α-deuterophosphonium salts lose the isotope to the solvent. In all the Wittig reactions, benzene was formed as a by-product in 10 to 15% yield. The mechanism of benzene formation is probably analogous to that proposed by Seyferth involving the decomposition of a pentacovalent phosphorous intermediate. (auth)

28352 THERMAL AND RADIATION STABILITY OF ORGANIC COOLANTS. I. EFFECTS OF AROMATIC COMPOUNDS ON THE THERMAL DECOMPOSITION OF DIPHENYL. I. Janovsky and J. Bednar (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Rez). Collection Czech. Chem. Commun., 30: 900-3(Mar. 1965).

The effects of aromatic compounds on the thermal decomposition of diphenyl at 440°C were investigated. Naphthalene and α-methyl-naphthalene somewhat improved the stability of diphenyl to thermal decomposition at 440°C, whereas the remaining compounds (β-methyl-naphthalene, 1,6-dimethyl-naphthalene, 2,6-dimethyl-naphthalene, anthracene, phenanthrene, and fluorene) either showed no effects or increased its decomposition. (auth)

28353 SYNTHESIS OF $C^{14}F_3CH_2OH$. R. L. Ehrenfeld (Halocarbon Labs., Inc., Hackensack, N. J.) and J. L. Morgenthau, Jr. Intern. J. Appl. Radiation Isotopes, 16: 331-2(May 1965).

The preparation of $^{14}CF_3CH_2OH$ by sulfur tetrafluoride fluorination of bromoacetic acid followed by hydrolysis of the resulting trifluoroethyl bromide is described. The yield based on bromoacetic acid was 50%. (M.C.G.)

28354 AN IMPROVED SYNTHESIS OF 5-IODO-2′-DEOXYURIDINE-I^{131} AND 5-IODOURACIL-I^{131}. N. M. Bui, R. Gillet, and P. Dumont (Catholic Univ. of Louwain, Belg.). Intern. J. Appl. Radiation Isotopes, 16: 337-9 (May 1965).

Use was made of iodine monochloride as an electrophilic substituting agent for the preparation of ^{131}I-labeled 5-iodo-2′-deoxyuridine of high specific activity. The ^{131}I incorporated by this method averaged up to 90% of the theoretical value. The reaction was extended, with still better yields, to the preparation of ^{131}I-labeled 5-iodouracil. (M.C.G.)

28355 DISMUTATION REACTIONS OF NUCLEOSIDE POLYPHOSPHATES. II. SPECIFIC CHEMICAL SYNTHESES OF α-, β-, AND γ-P^{32}-NUCLEOSIDE 5′-TRIPHOSPHATES. W. E. Wehrli, D. L. M. Verheyden, and J. G.

Moffatt (Syntex Inst. for Molecular Biology, Palo Alto, Calif.). J. Am. Chem. Soc., 87: 2265-77(May 20, 1965).

Specific chemical synthesis of α-, β-, γ-, and β,γ-^{32}P-labeled ATP were developed in which no detectable isotope is present in other than the desired position. The reaction of adenosine 5′-diphosphate with morpholine and dicyclohexylcarbodiimide gave ADP-morpholidate (II), which was allowed to react with ^{32}P-tributylammonium orthophosphate to give γ-^{32}P-ATP. The reaction of p-nitrobenzyl phosphoromorpholidate with ^{32}P-orthophosphate gave β-^{32}P-p-nitrobenzyl diphosphate, which was condensed with AMP-morpholidate giving γ-p-nitrobenzyl β-^{32}P-ATP, which on hydrogenolysis gave β-^{32}P-ATP. Phosphorylation of 2′,3′-O-isopropylideneadenosine with ^{32}P-2-cyanoethyl phosphate gave ^{32}P-AMP, which was converted into the phosphoromorpholidate and condensed with pyrophosphate to give α-^{32}P-ATP. In a similar way, condensation of nucleoside phosphoromorpholidates with ^{32}P-pyrophosphate gave β,γ-^{32}P-nucleoside 5′-triphosphates. The synthesis of ATP-morpholidate (IV) and its use in the synthesis of various adenosine 5′-tetraphosphates is also described, as well direct syntheses of the terminal monomethyl esters of adenosine 5′-tri- and -tetraphosphates. (auth)

28356 SECONDARY HYDROGEN ISOTOPE EFFECTS. PART III. THE MECHANISM OF N-NITRATION. E. A. Halevi, Arza Ron, and Shammai Speiser (Israel Inst. of Tech., Haifa), J. Chem. Soc: 2560-9(Apr. 1965).

A preliminary kinetic study of the N-nitration of N-methyl-2,4,6-trinitroaniline in an aqueous strong acid showed that deuteration of the methyl group causes a very slight depression of the apparent nucleophilic reactivity of the substrate, although its basicity is increased by some 11%. The assumption that attack by NO_2^+ might not be rate-determining in these conditions, was confirmed. The rate of nitration of the parent compound, which has a rapidly exchangeable amino hydrogen atom, was measured separately in $H_2SO_4-H_2O$ and $D_2SO_4-D_2O$. The solvent isotope effect was eliminated by comparing the rates in the two media under conditions of equal nitrating power, as measured by the rate of C-nitration of a reference aromatic compound, toluene-α-sulfonic acid. The primary isotope effect, k(H)/k(D), rises smoothly from 1.0 to 4.8 as the acidity of the medium increases, indicating that proton abstraction, rapid at low acidities, becomes rate-controlling in solutions of high nitrating power. A re-investigation of the effect of methyl deuteration reveals the expected inverse secondary isotope effect, which decreases smoothly from about 19% in conditions of rate-controlling addition of NO_2^+, and is eventually reversed to the previously observed slight normal effect (about 2%) when proton abstraction is rate-limiting. (auth)

28357 ISOTOPIC-EXCHANGE STUDY OF THE SUBSTITUTION REACTIONS OF COBALT (II) AND ZINC (II) IONS WITH THEIR ETHYLENE DIAMINE TETRA-ACETIC ACID (EDTA) COMPLEXES. S. S. Krishnan and R. E. Jervis (Univ. of Toronto). Trans. Am. Nucl. Soc., 8: 170-1(May 1965).

28358 NUCLEAR REACTOR COOLANTS. Eduard C. Kooyman (to Shell Oil Co.). Canadian Patent 693,038. Aug. 25, 1964. Priority date Sept. 5, 1958, Netherlands.

A hydrocarbon mixture is proposed as an improved heat transfer agent for use in nuclear reactors. The mixture is composed of 1,3,5-triphenylbenzene mixed with a material selected from the following: a terphenyl, mixtures of isomeric terphenyls, biphenyl, monoisopropyl biphenyl, alkyl derivatives of 1,3,5-triphenylbenzene in which each alkyl group contains no more than 4 carbon atoms, aromatic petroleum extracts, or mixtures of any of these. The preferred mixture is 80 mole % 1,3,5-triphenylbenzene and 20 mole % terphenyl. The material is very stable with regard to high temperature and nuclear radiation. All or a portion of the heat transfer agent can be subjected to a purification process to remove any impurities during use. (B.L.M.)

Radiation Chemistry

See also BIOLOGY AND MEDICINE — Radiation Effects.

Refer also to abstracts 28685 and 29031.

28359 (AERE-R-4871) THE RADIOLYTIC OXIDATION OF METHANE. PART 2. THE FORMATION OF HYDROCARBONS, ALCOHOLS, ESTERS, ETHERS AND OTHER MINOR PRODUCTS. J. A. Hearne and R. W. Hummel (Research Group, United Kingdom Atomic Energy Authority, Wantage (England)). Nov. 1964. 42p. Dep.; $1.20(BIS, 6s. (HMSO).

The yields of methanol, ethanol, ethylene, acetaldehyde, methyl formate, and minor products from the 4-Mev electron and ^{60}Co γ radiolysis of 10% O_2-CH_4 mixture at 25°C, were studied over pressure and dose rate ranges of 1–76 cm Hg and $2.43 \times 10^{14}-5.38 \times 10^{17}$ ev ml^{-1} min^{-1} normalized to 20°C and 76 cm Hg. A reaction scheme is proposed on the basis of the results work and published data. (auth)

28360 (BNL-9043) CHARACTERIZATION STUDIES FOR POLYETHYLENE FORMED BY Co^{60} GAMMA RADIATION UNDER CONSTANT CONDITIONS IN A NON-FLOW SYSTEM. P. Colombo, J. Fontana, L. E. Kukacka, and M. Steinberg (Brookhaven National Lab., Upton, N. Y.). Mar. 1965. Contract AT(30-2)-Gen-16. 34p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

The yield and rate of polymerization of ethylene by ^{60}Co gamma radiation in a non-flow system have been described in BNL Report 8801. The polyethylene formed over the wide range of conditions reported in BNL 8801 was evaluated and a description of some of the properties are given. The reaction vessel used for the above experiments, is of 316 stainless steel and had an internal volume of 100 cc. The bottom assembly contains a thermocouple well for measuring reaction temperature and the upper assembly contains a rupture disc and a closure valve. Another series of experiments were carried out in an elongated or "fall-through" vessel. This type of reaction vessel has an internal volume of 420 cc and a length of 30 in. The low part of the vessel was inserted into a lead shielding cask so that only the top 6 in. (120 cc volume) is subjected to radiation. The purpose of the elongated vessel was to allow the polymer to fall out of the radiation field as it is formed. Polymer characterization data are presented for experiments conducted in the 100 cc capsule reaction vessel and for experiments performed in the elongated vessel. All radiations were conducted in the water tank-type facility in the High Pressure Gamma Laboratory. (D.L.C.)

28361 (BNL-9174) CHEMICAL STATE OF IODINE RELEASED FROM IRRADIATED FUELS INTO STEAM. A. W. Castleman, Jr., I. N. Tang, and H. R. Munkelwitz (Brookhaven National Lab., Upton, N. Y.). Apr. 1965. Contract AT(30-2)-Gen-16. 18p. (CONF-650407-3). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From International Symposium on Fission Product Release and Transport under Accident Conditions, Oak Ridge, Tenn.

An experimental study was made of the chemical states of fission-product iodine released at 1000 to 1300°C from irradiated U, UO_2, and U_3O_8 into steam. The radioinduced decomposition of methyl iodide, which was found in some of the experiments, were also studied. The probable reactions of iodine under reactor accident conditions are discussed. (D.L.C.)

28362 (TID-21885) HOMOGENEOUS AND GRAFT COPOLYMERIZATION OF STYRENE BY IONIZING RADIATION (thesis). Sundaresa Srinivasan (Maryland Univ., College Park. Dept. of Chemical Engineering). 1965. Contract AT(40-1)-2845. 75p. Dep.(mn); $3.00(cy), 2(mn) CFSTI.

Measurements were made of polymer addition to polyethylene films and polyethylene fluff immersed in liquid styrene and exposed to gamma radiation; in addition, the

formation of polystyrene dissolved in styrene was determined. The results lead to three conclusions: (1) the bulk of the polymer addition to polyethylene films is occluded homopolymer; (2) the true graft of styrene to polyethylene follows a kinetic mechanism that is very similar to that of the polymerization of liquid styrene; (3) the actual graft process and the dissolved homopolymer formation have an anomalously low activation energy in the region 20–40°C. An attempt was made to explore, confirm, and explain the nonlinear behavior of the Arrhenius plot of the homopolymer formation in the grafting reaction through detailed studies on pure liquid styrene. Radiation-induced polymerization rates and molecular weights were measured over a wide range of temperatures and dose rates; similar measurements were made in thermal polymerization studies. The results are compared with many investigations already published. The major conclusions are: (1) polymerization rates follow a half-order dependence on the dose rate; (2) molecular weight does not depend on dose rate in a simple manner even when transfer effects are considered; (3) the apparent radiation yield of chain initiators increases at low dose rates; and (4) no obvious combination of free radical and ionic mechanisms proposed to date fits the data. (D.L.C.)

28363 (UCRL-16009) THE PRODUCTION OF TRITIUM-LABELED METHANE AND ETHANE IN THE CH_4–T_2 SYSTEM (thesis). John B. Nash (Lawrence Radiation Lab., Univ. of California, Berkeley). Apr. 12, 1965. Contract W-7405-eng-48. 114p. Dep.(mn); $4.00(cy), 2(mn) CFSTI.

The rates of incorporation of tritium into labeled methane and ethane in the methane–tritium system were investigated. The production of the tritiated products can be expressed by a sum of two terms. The first term of this expression is independent of time, and is the decay-induced labeling; the other, inversely proportional to time, is the radiation-induced labeling. The rate of incorporation of tritium into product as a result of the radiation field is shown to have a dependence on the absolute molecular concentration of tritium as well as its concentration as a source of radiation. The yields of labeled methane and ethane from the decay labeling is directly proportional to the rate of decay of the tritium. The rate of incorporation of tritium into labeled ethane is larger than that for incorporation into tritiated methane. A mechanism for both series consistent with the results is proposed. The effect of additives was also determined. Addition of hydrogen elucidated the rate of labeling from the decay-induced series. Xenon was shown to enhance the product yield by 15 percent in concentrations up to 30 mole percent. Addition of ethylene in amounts less than 2 mole percent suppressed the labeling rate until the ethylene had disappeared by reaction with the radiolytic products. The effect on product formation of varying the pressure and the surface to volume ratio is also discussed. (auth)

28364 (UJV-1169/64) CHEMISCHE FOLGEN DES β-ZERFALLS VON ^{210}Bi IN TRIARYLWISMUTDIHALOGENIDEN. (Chemical Study of the β Decay of ^{210}Bi in Triarylbismuth Dihalogens). V. D. Nefedov, M. Vobecky, and J. Borak (Ústav Jaderného Výzkumu, Ceskoslovenská Akademie Věd, Řež (Czechoslovakia)). Jan. 1965. 6p. Dep. (mn).

It was attempted to determine the effect of the halogen in the molecule on the yield of the Ar_3PoX and Ar_2PoX_2-type compounds which are formed during the β decay of ^{210}Bi in crystalline compounds of Ar_3BiX_2, whereby X designates F, Cl, or Br and Ar represents o-, m-, p-tolyl or p-xylyl. The starting materials were prepared by Grignard synthesis from anhydrous $BiCl_3$; the ^{210}Bi was obtained by irradiating high-purity metallic Bi to a flux of 10^{13} n/cm^2·sec for 5 days. The decay products were collected in the mother compound at room temperature and were analyzed by chromatography on Al_2O_3 with and without nonisotopic carrier. The products were identified by comparing them with Po compounds; the quantitative determinations involved measurement of the α emission of ^{210}Po. It was found that the yield depends markedly on the halogen incorporated in the molecule: when changing from the difluoride to the analogous dibromide derivative, the Ar_3PoX increased strongly, being accompanied by a corresponding decrease of the Ar_2PoX_2 yield. The thermodynamically unstable $[Ar_3PoX_2]^+$ molecular ions are also a product of the β decay; their subsequent decomposition also depends on the halogen used. (TTT)

28365 (UJV-1170/64) SINTEZ π-KSILIL'NYKH PROIZVODNYKH POLONIYA PRI β-RASPADE V SOSTAVE ANALOGICHNYKH PROIZVODNYKH VISMUTA. (Synthesis of p-Xylyl Polonium Derivatives in β-Decay of Similar Bismuth Derivatives). V. D. Nefedov, M. Vobetski, and I. Borak (Ústav Jaderného Výzkumu, Ceskoslovenská Akademie Věd, Řež (Czechoslovakia)). Jan. 1965. 5p. Dep.(mn).

The following p-xylyl compounds containing bismuth tracer (RaE) were synthesized: $(p\text{-}C_8H_9)_3Bi$ and $(p\text{-}C_8H_9)_3BiCl_2$. Decay products were accumulated in the organic compound at room temperature, and were analyzed by thin-layer chromatography on Al_2O_3 with the use of a benzene-ethanol (5 : 1) mixture as a developer for the decay products of $(p\text{-}C_8H_9)_3Bi$, and a mixture of ethyl acetate–methanol (1 : 1) as a developer during analysis for the decay products of $(p\text{-}C_8H_9)_3BiCl_2$. The yield of Ar_3PoX was 67%, and the yield of Ar_2PO compound was 33% with $(p\text{-}C_8H_9)_3Bi$ as the initial compound. The yield of Ar_3PoX compound was 44%, and the yield of Ar_2PoX_2 compound was 56% with $(p\text{-}C_8H_9)_3BiCl_2$ as the initial compound. (TTT)

28366 (AEC-tr-6520) ANNUAL REPORT OF THE JAPANESE ASSOCIATION FOR RADIATION RESEARCH ON POLYMERS, VOLUME 4, 1962. Translation of "Nippon Hoshasen Kobunshi Kenkyu Kyokai Nempo, Vol. 4, 1962," (a publication of the Japanese Association for Radiation Research on Polymers). 44p. Dep.; $7.32(cy), 7(mn) CFSTI.

A total of 45 papers are presented on the following topics: dosimetry of electrons, radioinduced thermoluminescence, radioinduced graft polymerization, radioinduced solid-state polymerization, synthesis of tert-amyl alcohol, radioinduced reactions of organic compounds, and free radicals. For abstracts of 43 of the papers, see NSA 18: 27541 through 27582 inclusive and 27798. (D.L.C.)

28367 CONTRIBUTION CONCERNING THE MEASUREMENT OF ABSORBED RADIATION-DOSES AND G-VALUES DURING IRRADIATION OF ORGANIC COMPOUNDS IN NUCLEAR REACTORS. C. Salander and E. Ungethuem (Gesellschaft fur Kernenergieverwertung in Schiffbau and Schiffahrt mbH., Geesthacht, Ger.). Atomkernenergie, 10: 93-5(Mar.-Apr. 1965). (In German)

The method, by which G-values of capsule and loop experiments with organic substances were determined at the research reactor Geesthacht (FRG) by means of foil measurements and isothermal calorimetric methods is described. (auth)

28368 THE REACTION OF FREE HYDROGEN ATOMS AND IONIC INTERMEDIATE PRODUCTS OF THE GAMMA-RADIOLYSIS OF n-HEXANE WITH DEUTERATED HYDROGEN SULFIDE. G. Meissner and A. Henglein (Hahn-Meitner-Institut für Kernforschung, Berlin). Ber. Bunsenges. Physik. Chem., 69: 264-70(1965). (In German)

H_2, HD, and appreciable amounts of D_2 are formed in the irradiation of solutions of D_2S in n-hexane. With increasing D_2S concentration, $G(H_2)$ decreases, while G(HD) and $G(D_2)$ increase. With increasing temperature, $G(H_2)$ increases, G(HD) slowly decreases, and $G(D_2)$ shows a more rapid decrease. The total hydrogen yield is unaffected. In the presence of an H atom scavenger (tetramethylethylene), G(HD) is decreased and $G(D_2)$ is not influenced. An additional electron scavenger (nitrous oxide) does not appreciably change the HD yield, but $G(D_2)$ is strongly suppressed. Both yields are decreased by a scavenger for H atoms as well as electrons (carbon tetrachloride, biphenyl). In the presence of proton acceptors (isopropyl alcohol, methyltetrahydrofuran), $G(D_2)$ is also decreased while $G(H_2)$ and G(HD) are not strongly changed. These results show that hydrogen sulfide reacts with ionic intermediates and with

H atoms to form D_2 and HD, respectively. The quantitative evaluation of these experiments led to the conclusion that 50% of the thermalized H atoms from the γ radiolysis of saturated hydrocarbons (the yield of which amounts to about 3 atoms/100 ev) are produced in fast decay processes, which cannot be interfered with (H^{α} atoms). The other H atoms (H^{δ} atoms) have free electrons or ions as precursors, which form D_2 in their reactions with dissolved D_2S. In the presence of an electron scavenger a somewhat higher yield of $H^{\alpha} + e^{-}$ is always observed than of $H^{\alpha} + H^{\delta}$ in the pure hydrocarbon. This can be explained if it is assumed that H^{δ} atoms are not always produced in the neutralization of ion pairs. Various reaction mechanisms are discussed which include the migration of positive holes in n-hexane, the neutralization of ion pairs and reactions of free electrons. (auth)

28369 SYNTHESIS OF POLYURIDYLIC ACID BY GAMMA-RADIATION. A. Aguilera, E. Colombara, R. Jimenez, and J. Toha (Universidad de Chile, Santiago). Biochim. Biophys. Acta, 95: 569-77(Apr. 19, 1965).

Polyuridylic acid was formed by γ-irradiation (7.2×10^4 R) of aqueous solutions of uridylic acid (0.5×10^{-3} M). The yields of polymers were better when irradiation was carried out under vacuum, and at a dose rate of about 900 R/min. Higher concentrations of uridylic acid gave lower yields of polymers. The polyuridylic acid prepared by this method had the same chromatographic pattern as a standard polyuridylic acid. A system for continuous irradiation and isolation of the largest polymers is described. (M.C.G.)

28370 FEATURES OF THE SPECTRA OF ELECTRON PARAMAGNETIC RESONANCE OF AMINO ACIDS AND PROTEINS ON EXPOSURE TO ULTRA-VIOLET. O. A. Azizova (Inst. of Biology and Physics, Moscow). Biophysics (USSR) (English Transl.)., 8: No. 5, 611-16 (1963).

The electron paramagnetic resonance (EPR) spectra of ultraviolet-irradiated sulfur-containing amino acids were measured. A mechanism is proposed explaining the formation and conversion of radicals on ultraviolet irradiation. The EPR spectra of irradiated aromatic amino acids were also studied. The EPR spectra of various irradiated proteins were recorded and the kinetics of change in EPR signals of proteins were studied in relation to temperature. (auth)

28371 LOCALIZATION OF THE PARAMAGNETIC CENTER IN GAMMA IRRADIATED PROTEIN. M. K. Pulatova (Inst. of Biology and Physics, Moscow). Biophysics (USSR) (English Transl.), 8: No. 5, 700-3(1963).

The paramagnetic centers formed in proteins were localized by isotopic substitution of hydrogen by deuterium and by measuring the electron paramagnetic resonance spectrum. The localization of a paramagnetic center in the oxygen of the hydrogen bridge of the polypeptide chain was indicated. (M.C.G.)

28372 CREATION OF POLYMERIC STRUCTURES FOR SPACE MATERIAL DEVELOPMENT. Sharda Dasgupta (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. Aero.-Space J., 11: 133-41(May 1965). (AECL-2172)

A study was made of radiation damage mechanism in polymers and the utilization of radiation for the development of improved radiation-resistant materials. Methods for the creation of new and improved polymeric structures by utilizing radioinduced grafting techniques and the preparation and properties of some tailor-made copolymers are discussed. The reaction mechanism and the structural and compositional factors involved in the formation of these graft copolymers are outlined. (auth)

28373 CHARGE TRANSFER AND ELECTRON CAPTURE IN THE RADIOLYSIS OF ALIPHATIC HYDROCARBONS. P. J. Dyne (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Chem., 43: 1080-95(May 1965). (AECL-2174)

A mechanism is suggested for the radiolysis of hydrocarbons. Both ions and excited molecules are produced in the initial excitation. Ion–electron recombination leads to the formation of excited molecules, which have similar properties to those formed initially; all subsequent decomposition proceeds through these excited molecules. In mixtures of hydrocarbons, ions and molecules may undergo positive charge exchange and additives reduce the hydrogen yield by capturing electrons or reacting with the positive ion. The mechanism provides a rationalization for a variety of observations. (auth)

28374 THE RADIOLYSIS OF ETHANOL. IV. DEUTERATED ETHANOLS IN THE LIQUID AND GAS PHASES. J. J. J. Myron and G. R. Freeman (Univ. of Alberta, Edmonton). Can. J. Chem., 43: 1484-1559(May 1965).

The value of G(– ethanol) in the vapor phase was nearly double that in the liquid phase. Part of the difference appeared to be due to the recombination of radicals in liquid cages. Ethanol molecules, on the average, break into smaller fragments in the gas-phase than in the liquid-phase radiolysis. The isotopic compositions of the hydrogen produced from various deuterated ethanols were consistent with the suggestion that the reaction, $CH_3CH_2OH^+ + CH_3CH_2OH \rightarrow CH_3CH_2OH_2^+ + CH_3CH_2O$, occurs to a significant extent in the liquid but not in the gas phase. This reaction probably involves the shift of a hydrogen atom along a hydrogen bond. The reaction, $C_2H_5OH_2^+ + e_{solv}^- \rightarrow C_2H_5O + H_2$, did not occur to an appreciable extent in the liquid phase. In the liquid phase the relative contributions of the three different groups in the ethanol molecule to hydrogen production were in the order $CH_2 > OH \gg CH_3$. A similar trend occurred in the gas, although the contributions of the three groups were more nearly equal in this phase. Isotope effects, in the range $k_H/k_D = 2.2$ to 3.9 per bond, occurred in the methane formation mechanism. The isotope effects were somewhat smaller in the liquid than in the vapor phase and somewhat smaller in the inhibited than in the uninhibited systems. A comparison of product distributions in the liquid and gas radiolyses of several compounds by γ rays and by α particles indicated that LET (linear energy transfer) effects can also occur in the gas phase. (auth)

28375 NUCLEAR TECHNOLOGY IN A UNIVERSITY ENVIRONMENT. G. R. Hall (Imperial Coll. of Science and Tech., London). Chem. Ind. (London), No. 46, 1890-8(Nov. 14, 1964).

Results of some research projects using radiation in chemical syntheses of industrial importance are surveyed. Oxidation in several hydrocarbon systems is being studied, including aqueous solutions of oxygen with methane, ethane, and ethylene, respectively. The possibility of using the energy of the fission process in chemical production by utilizing the recoil kinetic energy of fission fragments is discussed. The radiation-induced breakdown of pure methane gas was examined with a view to comparing the action of recoil fission fragments, with the effect of other types of ionizing radiation. Irradiations of pure methane gas were carried out at pressures of up to 35 atm and at temperatures of up to 200°C. A wide range of higher hydrocarbons were produced and yields of these up to isopentane were measured, but no unsaturated hydrocarbons were detected. The yields for formation of hydrogen, ethane, propane, and butane were found to approximate the values observed using γ photons, fast electrons, and α particles. The problem of radioinduced decomposition of solvents and ion-exchange resins used to extract individual fission products from spent nuclear fuel is also being studied. The γ irradiation of a strong base resin such as Deacidite-FF in the hydroxide form results in a marked decrease in the strong base capacity over the range 0 to 1000 Mrad, and at the highest doses only weak base capacity remains. Salt forms of the resins are generally more resistant to irradiation than the hydroxide form. A significant and steady increase in the weak base capacity, resulting from the conversion of quaternary functional groups to tertiary amine groups, was observed at doses up to about 400 Mrad. The overall increase in weak base capacity was, however, quite small. Measurement of the yields (G) of basic products shows a predominance of tertiary amine in the aqueous

solutions associated with the irradiated resin, with yields of secondary and primary amine and ammonia increasing as irradiation proceeds. The radiation yield for ammonia is very small up to 100 Mrad and then becomes constant at G = 1.3 above 150 Mrad. Possible mechanisms to explain the reactions involved are discussed, particularly the formation of secondary products. A fundamental investigation of the radiation chemistry of aromatic amines was undertaken, using model compounds, including benzyldimethylamine and benzyltrimethylammonium hydroxide. It was found that other processes leading to addition to the aromatic nucleus are as important as liberation of aliphatic amine from C-N bond scission. Irradiation in the presence of nitrate ion indicated a strong protective effect against C-N bond rupture, a result found also in extensive studies of resin chloride and nitrate. C-N bond scission may be a result of reaction of the resin functional group with the hydrated electron (H_2O^-) produced during radiolysis of water. Problems encountered in nuclear fuel reprocessing, when strong base resins are used for removing Pu and other α-particle emitters from solutions containing other radioactive impurities, are also considered. (BBB)

28376 EFFECTS OF SOME SOLUTES ON THE RADIOLYSIS OF METHANOL. J. Teply and A. Habersbergerova (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Rez). Collection Czech. Chem. Commun., 30: 785-92(Mar. 1965).

With increasing ferric chloride concentration, the yield of formaldehyde first increased steeply and then slowly decreased, whereas the yields of the other products decreased in the given concentration range. The increase of the formaldehyde yield is explained by the increased concentration of $CH_3OH_2^+$ ions in ferric chloride solution and by their reactions with unsolvated electrons. The change of the kinetics of these reactions at a concentration of 10^{-3} M was explained by the reactions in the spurs. Another unidentified product was assumed at higher ferric chloride concentrations. In iodine solutions for formaldehyde yield and the consumption of iodine first increased steeply with increasing iodine concentration and then decreased together with the yields of the other products. No adequate explanation was found. Studies were also made of the effects of potassium iodide, methyl iodide, and carbon tetrachloride. (auth)

28377 RADIOLYSIS OF PURE METHANOL. J. Teply, A. Habersbergerova, and K. Vacek (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Rez). Collection Czech. Chem. Commun., 30: 793-801(Mar. 1965).

The reaction mechanism of radiolysis was suggested on the basis of the product yields from methanol radiolysis measured in the temperature range from 77 to 293°K, using known mass spectrometric and photochemical data. The temperature dependence of the yields of hydrogen, formaldehyde, and ethylene glycol is tentatively explained by the different reactions of solvated and unsolvated electrons with positive ions. The CH_2OH^- radicals measured as a triplet in the EPR spectrum of methanol irradiated at 77°K disappeared at a temperature of 111°K by a bimolecular reaction; its rate constant at this temperature was 16 $mol\text{-}l^{-1}\ sec^{-1}$. (auth)

28378 AMORPHIZATION OF MUSCOVITE MICA BY IRRADIATION WITH FISSION FRAGMENTS. Michel Romieu and Jacqueline Bloch (Centre d'Études Nucléaires, Fontenay-aux-Roses, France). Compt. Rend., 260: 4194-7 (Apr. 12, 1965). (In French)

The effect of uranium fission products on Muscovite mica by radiocrystallographic analysis was studied. The progressive destruction of the crystalline structure with passage to the amorphous state with a flux of 1.5×10^{13} fission particles/cm^2 was established. In this state, the rotating crystal diagrams presented two characteristic rings at angles of 24° and 27.5° for the K_α ray of copper. For weaker fluxes, a progressive disappearance of the diffraction spots and a slight increase of the ratio c/a were noted. (tr-auth)

28379 RADIATION POLYMERIZATION OF POLYALKYLACRYLATES. V. I. Gol'danskii, I. G. Gusakovskaya, E. V. Egorov, G. V. Korolev, and V. B. Rapoport (Inst. of Chemical Physics, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 160: 646-9(Jan. 21, 1965). (In Russian)

The kinetics of radioinduced polymerization of alkyl acrylates were studied, and the obtained relations were compared with those pertaining to the three-dimensional thermal polymerization of the same monomers. A method of direct measuring of the heat evolved in the polymerization was applied for the first time. Poly(alkyl methacrylate) oligomers (MB from butanediol methacrylate) and two condensation products of butanediol and methacrylic and phthalic acid (MBP-1 and MBP-2), differing in the length of the oligomer chain, were used. The viscosity of the medium was increased by adding varying amounts of an inert, highly viscous solvent, IDP-2 (a condensation product of isobutyric acid, diethylene-glycol and phthalic acid). Irradiation was carried out either in a GUT-400 ^{60}Co installation (dose rate 3–21 rad/sec) or in an electron accelerator (dose rate 10^4–10^5 rad/sec) at 20–25°C. The results were recorded by a thermograph, which produced the heat evolution curve vs the time of irradiation. Analytical processing of the data gave the curves of the reduced polymerization rate vs dose rate and vs the degree of conversion. It was found that, as in thermal polymerization, oxygen inhibits the process of radioinduced polymerization, and that the process has a chain-radical mechanism of conversion. However, two differences were noted: In radiation polymerization hot radical recombination in the rigid three-dimensional structure was more difficult. Therefore, it was assumed that the dissipation and the transfer of energy necessary for the propagation of the polymerization took place along the polymer chains, which acquired a certain mobility, and that energy transfer was effected by a gradual excitation of the energy levels along the chains. The latter assumption was confirmed by the independence of the polymerization rate on the viscosity of the medium, which inhibits the direct diffusion of radicals. Radiation polymerization produced complete conversion (up to 100%) whereas chemically induced polymerization cannot achieve such a high degree of conversion even at high temperatures. Energy transfer along the chains also explains the improvement in physical and mechanical properties of the polymers. For example, the heat stability of the radiation-induced poly(alkyl acrylates) is several times higher than that of chemically cured polymers. The increased energy of the separate elements of the three-dimensional structure apparently produces a relaxation of inner stresses, a kind of high-temperature annealing of the polymer. (ATD)

28380 SOLVENT-SENSITIZED RADIOCHEMICAL REACTIONS. I. REARRANGEMENT REACTIONS OF CONJUGATED UNSATURATED STEROID KETONES. J. Hoigné, K. Schaffner, and R. Wenger (Eidgenossische Technische Hochschule, Zurich). Helv. Chim. Acta, 48: 527-38(1965). (In German)

Two unsaturated steroidal ketones undergo rearrangements on γ-irradiation in liquid solutions in the presence of aromatic sensitizers. The G-values in benzene solution were about 2, with only a small concentration dependence in the range from 0.015 to 0.39 mole/liter; τ (lifetime of benzene-excitation) multiplied by k_3 (reaction rate constant for energy transfer) was 290 1/mole. Decomposition was negligible. The rearrangements corresponded to those previously found on ultraviolet irradiation, and the γ-induced product distribution in benzene and toluene was similar to that obtained photochemically with wavelengths >280 nm. Another saturated ketone was stable when subjected to γ irradiation under identical reaction conditions. The nature of the energy transfer reaction from aromatic molecules to the ketones is discussed. The radiolysis of the aromatic solvent is not quenched by this energy transfer process. (auth)

28381 A NEW WAVELENGTH SHIFTER FOR LIQUID AND PLASTIC SCINTILLATORS. G. Vasvari (Central Research Inst. for Chemistry, Hungarian Academy of

Sciences, Budapest). Intern. J. Appl. Radiation Isotopes, 16: 327-9(May 1965).

An attempt was made to prepare an oxazole derivative, which in most respects should be similar to POPOP (1,4-di-[2-(5-phenyloxazolyl)]benzene), but would have a luminescent light maximum nearer to 4500 Å. The compound 1,4-di-[2-(5-tolytoxazolyl)]benzene (TOPOT) was prepared. It was a yellowish crystalline solid melting at 254 to 255°C. Its luminescent light maximum was higher than that of POPOP by about 80 Å. The decay time of the scintillator produced with TOPOT equaled that of stilbene crystals and its light output surpassed that of POPOP by about 20%. The counting efficiency of the scintillator made with TOPOT was not inferior to the efficiency of another one measuring with an instrument adjusted for the scintillator containing POPOP. (M.C.G.)

28382 STABILITY OF HIGH SPECIFIC ACTIVITY IODINE-131-LABELED INSULIN. L. J. Anghileri (Comision Nacional de Energia Atomica, Buenos Aires). Intern. J. Appl. Radiation Isotopes, 16: 336(May 1965).

A method was developed for preparation of ^{131}I-labeled insulin, which, immediately after preparation, showed no damaged insulin. The yield was 45 to 57% and the specific activity was 700 to 800 mC/mg. After 1 to 15 days the amount of damaged insulin varied from 10.6 to 66.6%. (M.C.G.)

28383 INFLUENCE OF RADIATION ON THE CAVITATION THRESHOLD OF DEGASSED WATER. R. D. Finch (Univ. of California, Los Angeles). J. Acoust. Soc. Am., 36: 2287-92(Dec. 1964).

The effects of neutron irradiation on the cavitation threshold of degassed water were studied. Cavitation was induced in water at the center of a 12-liter spherical resonator at a frequency of 25 kc/sec. For water degassed so that the equilibrium air pressure above it was less than 4 mm Hg, the threshold was found to be 9 ± 3 atm, provided that the sound field was not radically different from an ideal radial mode. It was also possible to obtain thresholds consistently higher (up to 80 atm) in a mode in which the central maximum was enhanced. A Picker-Dresser neutron generator producing 14-Mev neutrons at a rate of 10^8/sec was used to irradiate the resonator, and the threshold was always lowered by 10 to 50%, whichever mode was used, there being a time lapse of about ½ hr for the full effect of the irradiation to take place. A 1.0-cm thick lead screen placed over the resonator produced a rise in threshold of 10 to 50% as often as it apparently produced no effect. It was concluded that neutron irradiation affects the cavitation threshold of degassed water and that cosmic radiation probably does also. (TCO)

28384 ELECTRON PARAMAGNETIC RESONANCE STUDIES OF IRRADIATED γ-SILICA IN STATIC SYSTEMS AND UNDER DYNAMIC FLOW CONDITIONS. R. Haul, J. Karra, and J. Turkevich (Princeton Univ., N. J.). J. Am. Chem. Soc., 87: 2092-7(May 20, 1965).

An electron spin resonance study was carried out on the reactions of irradiated silica with oxygen, nitric oxide, and a number of gases. The appearance of a doublet characterized the adsorption of the oxygen and nitric oxide. This was shown to be due to the relaxation of spins on the surface of the irradiated silica. A flow system was developed to study by pulse techniques the reaction of gases with the solid. (auth)

28385 CHEMICAL EVIDENCE FOR THE OCCURRENCE AND TEMPERATURE INDEPENDENCE OF ION-MOLECULE REACTIONS AT ATMOSPHERIC PRESSURES. R. H. Lawrence, Jr., and R. F. Firestone (Ohio State Univ., Columbus, Ohio). J. Am. Chem. Soc., 87: 2288-90(May 20, 1965).

Chemical evidence is presented for the occurrence of an ion-molecule chain reaction sequence at pressures ranging from 0.85 to 0.95 atm in the tritium β-induced exchange between CH_4 and D_2. Results indicated that these reactions require no thermal activation energy. (M.C.G.)

28386 INFLUENCE OF THE DIELECTRIC CONSTANT ON THE YIELD OF FREE IONS PRODUCED DURING RADIOLYSIS OF A LIQUID. G. R. Freeman and J. M. Fayadh (Univ. of Alberta, Edmonton). J. Chem. Phys., 43: 86-92(July 1, 1965).

The γ-induced conductance of liquid diethyl ether was consistent with the previously developed theory. The following values of G (free ion) were determined by the conductance method: n-hexane, 0.10; cyclohexane, 0.10; p-dioxane, 0.05; n-butyl ether, 0.11; ethyl ether, 0.19; n-butyl bromide, 0.27; and n-butyl chloride, 0.39. Values of G (free ion) in other systems were obtained from spectroscopic and chemical studies reported in the literature. G (free ion) was roughly proportional to the static dielectric constant of the liquid, over the range studied. A theory is presented, which explains the results. It appeared that the slowed-down secondary electrons are "trapped" in the liquid and solvated before undergoing geminate recombination, even in alkanes. Solvated electrons in alkanes would probably have a charge-transfer type of absorption spectrum, with a broad absorption maximum in the infrared. The major portion of ion pairs that undergo geminate recombination in these liquids does so in a period of $10^{-10\pm1}$ sec. A general mechanism was formulated for the initial stages of the ionic part of a liquid-phase radiolysis reaction. (auth)

28387 CHARGE SCAVENGING DURING THE RADIOLYSIS OF LIQUID CYCLOHEXANE. G. R. Freeman (Univ. of Alberta, Edmonton). J. Chem. Phys., 43: 93-4(July 1, 1965).

A reaction mechanism is presented which quantitatively explains the charge-scavenging results of F. Williams in terms of the nonhomogeneous distribution of separation distances of the positive ions from their counterions. (auth)

28388 H_2-TRANSFER REACTIONS IN THE GAS-PHASE RADIOLYSIS OF HYDROCARBONS. P. Ausloos and Sharon G. Lias (National Bureau of Standards, Washington, D. C.). J. Chem. Phys., 43: 127-35(July 1, 1965).

The radiolysis of cyclohexane was investigated in the presence of varying concentrations of acetylene, ethylene, propylene, butene, and cyclopropane. On the basis of a number of observations, it was concluded that, in all cases, the H_2-transfer reaction, C_nH_m + cyclo-$C_6H_{12}^+ \rightarrow C_nH_{m+2}$ + $C_6H_{10}^+$, does take place. No extensive rearrangement occurs in the collision complex. For instance, a transfer of H_2 to CD_3CDCD_2 resulted exclusively in the formation of CD_3CDHCD_2H, while an H_2 transfer to $(CD_2)_3$ led to the formation of $CD_2HCD_2CD_2H$. Relative rate constants for the transfer of an H_2 molecule to CH_3CHCH_2, 1-C_4H_8, iso-C_4H_8, 2-C_4H_8, C_2H_4, and C_2H_2 were respectively, 1.00, 0.68, 0.27, 0.10, 0.11, and 0.072. Similar variations in the relative rate constants of the H_2^--transfer reaction $C_nH_m^+$ + cyclo-$C_6H_{12} \rightarrow C_nH_{m+2}$ + $C_6H_{10}^+$ were noted. When cyclopentane or n-pentane was substituted for cyclohexane in the reaction mixture, the H_2-transfer reaction again occurred. Under comparable experimental conditions, the probability of the H_2-transfer reaction was proportional to the yield of the parent ion as derived from the 70-ev mass-spectral cracking patterns. An increase in the pressure of cyclopentane, from 12.7 to 210 mm, led to approximately a 50% increase in the yield of the parent ion of cyclopentane. The parent cyclohexane ion underwent charge transfer to NO at a rate that was comparable to the rates of the H_2-transfer reactions. O_2 did not interact with the parent ion. The cyclopropane-d_6 parent ion reacted with cyclo-C_6H_{12} to form CD_3CDHCD_2H, indicating that this ion acquires the propylene ion structure prior to or during reaction. (auth)

28389 RADIATION CHEMISTRY OF CARBOHYDRATES. PART XV. MECHANISM OF SELF-DECOMPOSITION OF [^{14}C]D-GLUCOSE. G. O. Phillips and K. W. Davies (University Coll., Cardiff, Wales). J. Chem. Soc.: 2654-8(Apr. 1965).

Radioisotopic methods were used to measure the rate of self-decomposition of [^{14}C]D-glucose under standarized conditions of geometry, so that the fraction of the emitted energy absorbed by the solid can be calculated. From the results initial G-values for the self-decomposition are

26 to 29. Moisture increased the decomposition rate. The high G-values were similar to those encountered during γ-irradiation of polycrystalline anhydrous α-D-glucose. Under normal freeze-dried conditions, direct action effects are considered to be responsible for the major portions of the self-decomposition. (auth)

28390 THE STUDY OF THE RADIOLYSIS OF POLYISOBUTYLENE. Jeanne Danon (Faculté des Sciences, Orsay, France). J. Chim. Phys., 62: 281-6(Mar. 1965). (In French)

The effect of radiation on the molecular magnitudes $[\eta]$, $\overline{M}_n$, and $\overline{M}_p$ of polyisobutylene was studied to determine the value of the degradation yield from the absolute measurement from the molecular masses of the irradiated samples and to examine the problem of reticulation during radiolysis. The samples were exposed to γ radiation for various periods of time both in vacuum and in air. The viscosity, the mean molecular mass weight, and the mean molecular mass number were determined. The results are shown graphically and in tables. The results showed that oxygen had no appreciable effect on the radiolysis. The results on the radiochemical degradation represented a good mean of results found by other authors. The study of reticulation indicated that weak recombination occurred. (J.S.R.)

28391 STRESS RELAXATION OF γ-IRRADIATED FLUOROCARBON ELASTOMERS. T. Yoshida, R. E. Florin, and L. A. Wall (National Bureau of Standards, Washington, D. C.). J. Polymer Sci., Pt. A, 3: 1685-1712(May 1965).

Poly(vinylidene fluoride), polytrifluoroethylene, and two rubbery copolymers with vinylidene fluoride were crosslinked by γ irradiation in vacuum. Radioinduced chain scissions in the copolymers were studied by observing the relaxation of stress at constant extension during further irradiation at 27°C, at 0.31-2.7 MR/hr in nitrogen and in air. From gel content, swelling, and elasticity, the values of G_c (crosslinking) and G_d (scission) were respectively; for CF_2CFH, $G_c = 2.2$ and $G_d = 0.4$; for CF_2CH_2, 2.0 and 0.3; for $CF_2CH_2 + C_3F_6$, 3.4 and 1.3; for $CF_2CH_2 + CF_2CFCl$, 1.8 and 1.4. The G_d values from stress relaxation were variable; the lowest were: for $CF_2CH_2 + C_3F_6$, 4.6 in nitrogen and 8.4 in air; for $CF_2CH_2 + CF_2CFCl$, 1.9 in nitrogen and 3.6 in air. (auth)

28392 IRRADIATION CROSSLINKING OF POLYETHYLENE: RELATIVE EFFICIENCY IN CRYSTALLINE AND AMORPHOUS STATES. Malcolm Dole and Kanji Katsuura (Northwestern Univ., Evanston, Ill.). J. Polymer Sci., Pt. B, 3: 467-72(June 1965).

The conditions for radioinduced crosslinking of polyethylene were studied in the amorphous and crystalline states. It was previously observed that the crosslinking efficiency in isotactic polypropylene rose rapidly with temperature to a maximum at about 100°C. This was also observed for polyethylene. It was concluded that the increase of crosslinking with temperature is a real effect. Because vinylene formation is largely independent of temperature, dose rate, phase, and the presence of benzene, the enhanced crosslinking yield must be balanced by an increase in $G(H_2)$. In the liquid phase of polyethylene $G(H_2)$ is 6.0 and G(X) (crosslinking) only about 2.0 (or perhaps 10 to 20% higher when corrected for chain scissions). As G(vinylene) is about 3.0, a discrepancy in the material balance of about one G-unit exists. At room temperature this difference seems to be made up by formation of polyenes but not in the case of liquid-state irradiations. Hence, in the latter case the discrepancy is probably due to intramolecular crosslinking. (F.J.H.)

28393 LIGHT SUSCEPTIBILITY OF THE ALLYL RADICAL IN γ-IRRADIATED POLYETHYLENE. Ulrich Deffner (Technische Hochschule, Munich). Kolloid-Z., 201: 65-6(Jan. 1965). (In German)

On irradiation of γ irradiated low pressure polyethylene, cooled to −196°C, the formation of alkyl radicals and the disappearance of allyl radicals could be examined with electron spin resonance. These radicals, formed by β,γ, or x irradiation in vacuum below −80°C are almost entirely of the alkyl type and have a half life on the order of hours at 25°C; they decompose by recombination or by formation of the allylic radicals once again. A 400-μ sheet of low pressure polyethylene was stretched to eight times its length, cut into 3-mm wide strips and sealed in quartz vessels after a slow evacuation to 5×10^{-6} Torr. The sample was then irradiated with a ^{60}Co source at −80°C, maintained 10 days at room temperature and heated two hours to 100°C. The irradiation was carried out with the sample in an unsilvered quartz Dewar filled with liquid N_2, using a very high pressure Hg lamp. The spectra before and after irradiation are illustrated and are described as similar to the patterns previously published and interpreted for allylic and alkyl radicals. They have the same G factor (2.0021 ± 0.0005). It cannot be stated at what position of the alkyl chain the unpaired electron may be found in the radical; a mechanism is suggested which admits the 1,2 transfer of a hydrogen atom to the allylic center to give the alkyl radical. (BBB)

28394 STUDIES OF THE BREAKDOWN OF L-ASCORBIC ACID BY IONIZING RADIATION IN AQUEOUS SOLUTION. PART 3. M. Z. Barakat, M. F. Abdel Wahab, and Y. M. Megahed (Cairo Univ.). Monatsh. Chem., 95: 1623-9 (1964). (In German)

Samples of a 0.1% solution of L-ascorbic acid were irradiated with 10,000 to 100,000 R from an external ^{137}Cs source. Decomposition products of the ascorbic acid were measured in the irradiated solutions. The velocity of decomposition of the ascorbic acid to dehydro-L-ascorbic acid increased with the intensity of irradiation, as it also did with other metabolites. These included 2,3-diketo-L-gulonic acid, L-threonic acid, and oxalic acid. Immediately after irradiation with small amounts of radiation the concentrations of the metabolites increased at rates that indicated high velocities for their formation. When a large amount of irradiation was used there was extensive decomposition with formation of CO_2. (BBB)

28395 CHEMICAL EFFECTS OF NUCLEAR RECOIL FOLLOWING (n,γ) REACTIONS IN BROMATES. Nobufusa Saito, Fumitoshi Ambe, and Hirotoshi Sano (Tokyo Univ.). Nature, 206: 505(May 1, 1965).

The chemical distribution of radioactive recoil atoms arising from the $^{79}Br(n,\gamma)^{80m}Br$ and $^{81}Br(n,\gamma)^{82}Br$ reactions in a variety of bromate salts measured in order to clarify the mechanism of the recoil process. In any bromate salt investigated, except for a thallous salt, the retention of ^{82}Br was greater than that of ^{80m}Br. (W.L.G.)

28396 RECENT ADVANCES IN THE RADIOLYSIS OF AQUEOUS SYSTEMS. Gisuke Meshitsuka (Tokyo Metropolitan Isotope Research Center). Nippon Genshiryoku Gakkaishi, 7: 199-203(Apr. 1965). (In Japanese)

It was recently found that a second reducing species, the hydrated electron, plays a dominant role in the radiolysis of neutral and alkaline solutions. Characterizations are given of the primary species and reactions. Methods for determining chemical yields are reviewed. Measurement of the absolute reaction rate constants of the hydrated electron is described. (auth)

28397 SOLID STATE POLYMERIZATION OF BUTADIENE-1-CARBOXYLIC ACID. Kazumasa Kamada and Koichiro Hayashi (Mitsubishi Rayon Co., Ltd., Japan). Nippon Hoshasen Kobunshi Kenkyu Kyokai Nempo, 5: 83-94(Nov. 1964). (In Japanese)

The thermal polymerization and the radiation-induced polymerization of butadiene-1-carboxylic acid in the solid state and also in the liquid state (solution) were investigated. In various polymerization conditions, polymerization mechanisms and some properties of the polymers obtained were studied. Atmospheric oxygen has a marked accelerating effect on the rate of thermal polymerization but no effect on radiation-induced polymerization. In thermal polymerization, polymerization reactions occur from the surface of monomer crystals and amorphous polymer is obtained in powder form, so that monomer crystal is de-

stroyed as polymerization progresses. In radiation-induced solid-state polymerization, polymerization reactions proceed uniformly in crystals and monomer crystal appearance is retained to 100% conversion in its original form. When the process of polymerization was observed by a polarizing microscope, the degree of polarity did not change during progress of the reactions. The polymer at 100% conversion shows high orientation, but an amorphous structure was determined by x-ray-diffraction analysis for the polymer obtained by thermal polymerization in solid or liquid state. (auth)

28398 RADIATION-INDUCED CYCLOPOLYMERIZATION OF ACRYLIC ANHYDRIDE. Mitsuo Okada and Kanae Hayashi (Toyo Spinning Co., Ltd., Japan). Nippon Hoshasen Kobunshi Kenkyu Kyokai Nempo, 5: 95-103(Nov. 1964). (In Japanese)

Radiation-induced solution and bulk polymerization of acrylic anhydride were carried out over a wide temperature range for the purpose of studying the effects of temperature, phase, conversion, and initial monomer concentration on the degree of cyclization of the polymer obtained. The degree of cyclization increases with increasing conversion and temperature, and decreases with increasing initial monomer concentration. The degree of cyclization of the polymer formed in the solid state at -78°C is similar to that of the polymer obtained in toluene solution of the same temperature. But the polymer formed in the solid state is crosslinked. The determination of the residual unsaturation of the polymer by bromometry makes it possible to evaluate the ratio k_c/k_p of the rate constant of vinyl propagation and that of cyclization; for solution polymerization in toluene at 30°C, this ratio is equal to 0.09. Similarly, the difference between the activation energies of vinyl propagation and cyclization is evaluated to be 2.3 kcal/mole for solution polymerization in toluene, and 4.7 kcal/mole for bulk polymerization in the liquid state. (auth)

28399 RADIATION-INDUCED SOLID STATE POLYMERIZATION OF CYCLIC COMPOUNDS IN BINARY SYSTEMS. Masanobu Nishii and Koichiro Hayashi (Japanese Assn. for Radiation Research on Polymers, Osaka). Nippon Hoshasen Kobunshi Kenkyu Kyokai Nempo, 5: 105-13 (Nov. 1964). (In Japanese)

The radiation-induced polymerization of cyclic compounds in binary systems such as trioxane (TOX)–3,3-bis(chloromethyl)oxetane (BCMO), trioxane–diketene (DK), β-propiolactone (PL)–3,3-bis(chloromethyl) oxetane and β-propiolactone–diketene systems are reported. In these systems eutectic mixtures were produced and mixtures of homopolymers were obtained. The structure of these homopolymers was confirmed by infrared absorption spectra and x-ray-diffraction analysis. It is concluded that the radiation-induced solid-state polymerization proceeds in each crystal grain and propagating active species have no ability to cross over two crystal grains. (auth)

28400 RADIATION-INDUCED SOLID STATE POLYMERIZATION OF VINYL COMPOUNDS IN BINARY SYSTEMS. Masanobu Nishii and Hiroshi Tsukamoto (Japanese Assn. for Radiation Research on Polymers, Osaka). Nippon Hoshasen Kobunshi Kenkyu Kyokai Nempo, 5: 115-27 (Nov. 1964). (In Japanese)

The solid-state polymerization of vinyl compounds in binary systems such as acrylamide (AA)–methacrylamide (MAA) and acrylamide–acenaphthylene (ACN) systems is described. The first system forms a solid solution and polymerizes homogeneously in the solid state. The latter system forms a eutectic mixture and only polyacrylamide is obtained, because the rate of polymerization of acenaphthylene is much smaller than that of acrylamide. Acenaphthylene inhibits the polymerization of acrylamide in acetone solution, but in solid state it accelerates the polymerization of acrylamide. The post-polymerizations of these binary systems were also studied. The linearity between conversion and the logarithm of post-polymerization time was found on various monomer compositions. The relationship satisfied the kinetic equation presented by H. Morawetz et al., on the post-polymerization of acrylamide. Slope and intersect are changed by monomer composition and post-polymerization temperature. This means that the rate constant of propagation and termination reaction are changed by the crystalline state of the monomer mixture. Variations of intensity of x-ray diffraction of these monomer mixtures were also measured at various irradiation doses. In the case of the AA–MAA system, the intensities of all diffractions decreased as polymerization progressed. In the case of the AA–ACN system, the intensity of diffraction of acrylamide decreased but that of acenaphthylene was almost constant up to 1.4×10^6 R. These results mean that, in the AA–MAA system, the monomer mixture was polymerized homogeneously, and only the acrylamide crystal was polymerized in the AA–ACN system. (auth)

28401 SOLID STATE COPOLYMERIZATION OF MALEIC ANHYDRIDE AND ACENAPHTHYLENE INDUCED BY IONIZING RADIATION. Koichiro Hayashi and Seizo Okamura (Japanese Assn. for Radiation Research on Polymers, Osaka). Nippon Hoshasen Kobunshi Kenkyu Kyokai Nempo, 5: 129-38(Nov. 1964). (In Japanese)

Radiation-induced solid state polymerization in the system of maleic anhydride and acenaphthylene was carried out for the purpose of studying the solid state polymerization of vinyl compounds in binary systems. By melting-point measurement and differential thermal analysis, it was confirmed that the binary monomer system forms a eutectic mixture in the solid state. In solid-state polymerization these monomers have a maximum polymerization rate at the eutectic composition and polymerization products are a mixture of polyacenaphthylene and 1:1 maleic anhydride–acenaphthylene coopolymer. Since in solution polymerization 1:1 copolymer also was obtained, it was considered that solid-state copolymerization of maleic anhydride and acenaphthylene occurred in a liquid-like state at the boundary of two monomers. (auth)

28402 EFFECT OF PROTECTION IN GAMMA RADIOLYSIS OF DEAERATED NEDA, NETA AND NAPHTHALENE MIXTURES. Waclaw Stachowicz, Zbigniew Kecki, and Stefan Minc (Inst. of Nuclear Research, Warsaw). Nukleonika, 10: 89-94(1965).

Variations of the $G(H_2)$ values with the composition of deaerated two and three component mixtures of NEDA, NETA, and Naphthalene were determined. In all cases the deviation from the mixture-law considered here as energy transfer process, was found. (auth)

28403 RADIATION-INDUCED CONVERSION OF LIQUID HYDROGEN. T. E. Fessler and J. W. Blue (Lewis Research Center, Cleveland). Phys. Rev. Letters, 14: 811-12(May 17, 1965).

The effects of bremsstrahlung and fast neutrons on the ortho-para conversion in liquid hydrogen were investigated. Vapor-pressure difference measurements were made between two samples, containing equilibrium hydrogen and hydrogen condensed from room-temperature gas, respectively; the results were compared to the data of Scott to determine the change in the ortho-para composition before, during, and after irradiation. The results give a $4 \pm 2 \times 10^{-4}$ mole decrease in ortho composition/calorie of absorbed energy. (D.C.W.)

28404 EFFECT OF TURBULENCE ON RECOMBINATION LUMINESCENCE IN He II. Frank E. Moss, Frank L. Hereford, Forrest J. Agee, and James S. Vinson (Univ. of Virginia, Charlottesville). Phys. Rev. Letters, 14: 813-15(May 17, 1965).

The effects of a heat-current density in the region of the alpha tracks on both the intensity of alpha-induced scintillations in liquid helium and the ion current extracted from the alpha tracks by a strong electric field were studied. The results indicate that in the helium–II region there is no change in either the intensity or ion current at low heat-current densities. A sharp increase in scintillation intensity and a sharp drop in ion current were observed at a critical value of the current density. A hysteresis

effect was observed as the heat current was cycled above and below the critical value. (D.C.W.)

28405 ELECTRON SPIN RESONANCE OF AN IRRADIATED SINGLE CRYSTAL OF THYMIDINE. Brenda Pruden, Wallace Snipes, and Walter Gordy (Duke Univ., Durham, N. C.). Proc. Natl. Acad. Sci. U. S., 53: 917-24 (May 1965).

From ESR measurement of γ irradiated single crystals of thymidine, the principal, long-lived free radical produced by the irradiation is shown to be a secondary one formed by a hydrogen atom addition reaction on $C_{(6)}$ of the thymidine ring. The unpaired electron is in a π orbital of the ring with 0.70 of its spin density on $C_{(6)}$. A similar free radical gives rise to the thymidine-like resonance observed in DNA. (auth)

28406 PRIMARY PRODUCTS AND PROCESSES IN THE γ-RADIOLYSIS OF 2-METHYLTETRAHYDROFURAN. F. S. Dainton and G. A. Salmon (Leeds Univ., Eng.). Proc. Roy. Soc. (London), Ser. A, 285: 319-38(May 4, 1965).

A study was made of the uv, visible, near infrared, and ESR spectra induced by γ-irradiation at 77°K in glassy MTHF (methyltetrahydrofuran) and in glassy MTHF containing various additives and effects of controlled temperature increases on these spectra. The primary products of the radiolysis were electrons (e^-) and positive ions ($MTHF^+$), which undergo a rapid ion-molecule reaction to give $\square\overset{\bullet}{O}CH_3$ radicals (R•). The electrons can either be trapped in the glassy MTHF matrix or can be captured by either napththalene, ferric chloride, carbon tetrachloride, nitrous oxide or trans-stilbene if these substances are present. The e_T^- are bleachable by light or heat and disappear independently of the radicals R• without either augmentation of R• or the production of any new radical species. The e_T^- and R• disappear thermally and independently by second-order reactions. The rate expressions suggested that both reactions are diffusion controlled at low temperatures in the glassy phase. The kinetics of the thermal bleaching of e_T^- indicated that the electrons migrate distances of about 150 Å from their parent positive ions before being trapped in the matrix. The effect of $FeCl_3$ in reducing the formation of e_T^- at 77°K and its lack of effect on the thermal bleaching of e_T^- suggested that the reaction $e^- + FeCl_3 \rightarrow FeCl_2 + Cl^-$ only occurs before the electron is thermalized. (auth)

28407 THE RADIATION CHEMISTRY OF AQUEOUS SOLUTIONS OF NITROUS OXIDE. F. S. Dainton and D. C. Walker (Leeds Univ., Eng.). Proc. Roy. Soc. (London), Ser. A, 285: 339-59(May 4, 1965).

For carefully purified concentrated aqueous solutions of N_2O, $G(N_2)$ is initially greater than the steady-state value of 3.0 and $G(O_2)$ is less than the steady-state value of 1.45 when $G(H_2) = G(H_2O_2) \approx 0$. For very dilute solutions $G(N_2)$ is small, independent of dose rate, and decreases with increasing dose and decreasing $[N_2O]$, while $G(H_2)$ is initially >0.45, independent of dose rate, and decreases with dose. The high initial $G(H_2)$ is not due to organic or other impurity and is thought to arise either from bimolecular reactions of e_{aq}^- and H within a spur or track or from unimolecular decomposition of the solvated electron either to $H_2 + O^-$ or $H + OH^-$ or from a combination of both. The dose effects are attributed to competitive scavenging of e_{aq}^- by H_2O_2 as the latter is produced. Irradiation of an aqueous solution containing N_2O and H_2 induced a chain reaction between the two solutes ($N_2O + H_2 \rightarrow N_2 + H_2O$). At pH < 10 only short chains were involved, $G(N_2)$ increased with increasing $[H_2]$ and $[N_2O]$ but was largely independent of pH. The chain propagation reactions were thought to be $H + N_2O \rightarrow HO + N_2$ and $HO + H_2 \rightarrow H_2O + H$ and the chains terminated in about 0.1 msec by the cross-termination process $H + OH \rightarrow H_2O$ within the same track or spur. At pH > 10 the chain length increased to a constant value at pH ≥ 13.0, which was proportional to $[H_2]$ and independent of $[N_2O]$ and dose rate. This effect of pH was attributed to $OH \rightleftharpoons O^- + H^+$ with $11.5 < pK_{OH} < 12.7$ followed by $O^- + H_2 \rightarrow (H + OH^-) \rightarrow e_{aq}^-$. In this case the non-rate-determining propagation step was $e_{aq}^- + N_2O \rightarrow N_2 + O^-$ and chains originating in the same track, were terminated by mutual interaction of O^- radicals. Carbonate and bicarbonate ions reacted rapidly with OH and shortened the chain at pH < 12.5. (auth)

28408 THE EFFECT OF NUCLEAR REACTOR RADIATION ON CERTAIN ELECTRICAL AND MECHANICAL PROPERTIES OF EPOXIDE POLYMERS. Charles V. Kincaid (Naval Ordnance Lab., [White Oak, Silver Spring, Md.]), Robert W. Warfield, and Dick A. Duffey. Trans. Am. Nucl. Soc., 8: 4-5(May 1965).

28409 RADIOLUMINESCENT YIELD FROM A LIQUID-ORGANIC SCINTILLATOR EXCITED BY URANIUM-FISSION FRAGMENTS. E. Matovich (Autonetics, Anaheim, Calif.). Trans. Am. Nucl. Soc., 8: 64(May 1965).

28410 STUDIES ON X-AGENT. XLII. SOFT X-AGENT CAPABLE OF AFFECTING THE CLOUDINESS OF COLLOIDAL SOLUTIONS OF BISMUTH-OXYCHLORIDE. Hideo Moriyama (Shonan Hygiene Inst., Kamakura, Japan). Yokohama Med. Bull., 16: 9-16(Feb. 1965).

Previous studies of this hypothetical cosmic agent indicated that the turbidity of bismuth oxychloride solutions is influenced by X-agent. Both hard and soft components of the agent are said to be responsible for the effect. The soft component, which is reputed to affect the color of a neutral-red solution, is related to sunlight. Results of experiments are reported that were performed to show whether this soft component is also involved in the change of bismuth oxychloride solutions. The results showed that turbidity of bismuth oxychloride solution is affected by a soft X-agent which fails to pass through a sheet of aluminium foil. It is proposed that this soft agent can be demonstrated chiefly in the daytime. Its demonstration can be made beside a window, but not as readily in a position far from a window. Neutral-red solution is affected strongly when exposed to sunlight, and it is suggested that the soft agent altering the pigment solution is closely associated with sunlight, but that such a direct effect of sunlight cannot be proved with bismuth oxychloride solution. This fact is said to show that the soft agent concerned in turbidities of bismuth oxychloride solutions is different from that involved in neutral-red solution changes. The soft agent concerned in the change of bismuth oxychloride solution undergoes a marked daily fluctuation, but the fluctuation seemed to have no connection with the weather or atmospheric pressure. The action of the X-agent is said to consist of its ability to activate or alter the state of a substance upon which it falls; substances which are affected by the agent are considered to be in an activated or unstable state. (TCO)

28411 STUDIES ON X-AGENT. XLIII. CONVERSION OF ORDINARY LIGHT INTO X-AGENT. Hideo Moriyama (Shonan Hygiene Inst., Kamakura, Japan). Yokohama Med. Bull., 16: 17-30(Feb. 1965).

In continuing studies of this hypothetical cosmic agent, it was found that artificially produced light scattered from a bottle of water could sometimes exert an effect on neutral-red solutions arranged around the water bottle. This effect of the scattered light is said to resemble that of the soft X-agent scattered by the bottle. However, the effect of the scattered light was extremely variable on different days. Thus, some days the pattern of the effect had a resemblance to X-agent, while other days little or no effect was demonstrable with application of the same light. It is suggested that X-agent, which also changes in intensity from day to day, is involved in this phenomenon, whereby X-agent activates the water contained in the bottle, the light passing through the activated water being empowered with the ability to act as X-agent. Thus, the substance which is activated by X-agent and activated with the faculty to convert the light into X-agent is not confined to water. It is inferred that light is converted into X-agent; the energy imparted to a substance by X-agent is transferred to the light. The substance is said to be activated owing to the energy given to it by the X-agent, and therefore the X-agent is regarded as the light existing in an ac-

tivated state. Evidence is also presented that is said to show that the conversion to X-agent can take place with a wide range of electromagnetic radiations from γ rays to radio waves. (TCO)

28412 SPECTRAL AND TEMPORAL CHARACTERISTICS OF STIMULATED RADIATION FROM $CaF_2:Sm^{2+}$. Yu. A. Ananev and B. M. Sedov. Zh. Eksperim. i Teor. Fiz., 48: 782-90(Mar. 1965). (In Russian)

The spectrum of the stimulated radiation from $CaF_2:Sm^{2+}$ was investigated experimentally. The distribution of the radiation with respect to axial oscillation modes was studied. A continuous replacing of transverse oscillation modes was observed under steady-state emission conditions. It is demonstrated that the absence of oscillations in the integral radiation from $CaF_2:Sm^{2+}$ is due to the superposition of a large number of spikes over a certain period of time, the spikes being due to various transverse modes of oscillations. Information on the spatial distribution of various oscillation modes in the radiation was obtained. (auth)

28413 EFFECT OF INTERMOLECULAR COMPOUNDS ON THE FORMATION OF RADICALS IN THE γ-IRRADIATION OF SOME SOLID BINARY SOLUTIONS. V. A. Roginskii, A. G. Kotov, and S. Ya. Pshezhetskii (Karpov Inst. of Physics and Chemistry, USSR). Zh. Fiz. Khim., 39: 470-2(Feb. 1965). (In Russian)

The formation of radicals of γ radiation of some binary compounds, characterized by the presence or absence of intermolecular compounds, was investigated. The nonadditivity in the yield of resulting radicals in solutions in which intermolecular compounds exist was established. The general yield of radicals in some systems exceeds additive dimensions. The formation of radicals from alcohol was reduced and increased from the secondary components of the solution. The maximum effect was observed in the solutions corresponding to the composition of the intermolecular compounds. The "defense" of alcohol molecules at the expense of the increase of the dissociation of molecules of the secondary components was accomplished during which in some solutions one "defending" molecule of alcohol dissociates much more than one molecule of the secondary components of the solution. (tr-auth)

28414 THE INFLUENCE OF INTERNAL RADIATION IN ARMCO IRON AND STEEL-2 ON THE PROTECTIVE PROPERTIES OF CERTAIN INHIBITORS. S. A. Balezin and K. N. Yandushkin (Lenin State Pedagogical Inst., Moscow). Zh. Prikl. Khim., 38: 564-9(Mar. 1965). (In Russian)

Investigations of the effects of internal radiation on the protective properties of the sodium salts of nitrous, chromic, benzoic, and adipic acids (as inhibitors of neutral media) and the nitrite of dicyclohexylamine and the carbonate of monoethanolamine (as volatile inhibitors of atmospheric corrosion in Armco iron and steel-2) made it possible to establish some reduction of the protective properties of the inhibitors on irradiation with γ and β radiation. The protective concentrations found necessary for the prevention of corrosion of radioactive Armco iron and steel-2 in distilled water, was 2.5 to 15 times higher than the concentrations necessary for the protection of nonactive samples. On measurement of the electrode potential in distilled water with the addition of inhibitors, less improvement of the potential of radioactive samples was shown in comparison with the non-active samples. It was assumed that some reduction of the protective properties of the inhibitors was connected with the formation in the oxide film of significant numbers of microdefects, formed as the result of absorption at its emission energy. The possibility of using the investigated inhibitors for the protection of radioactive Armco iron and steel-2 at specific activities of 0.5 to 6 mC/g from corrosion in water and humid atmospheres was shown. (tr-auth)

28415 PROCESS FOR MAKING RADIOACTIVE IODINE. Geoffrey Irving Gleason (to Abbott Labs.). British Patent 985,029. Mar. 3, 1965. Filed June 15, 1961.

I^{131} can be made by irradiating meta-telluric acid with neutrons in a high-flux low-temperature reactor at a temperature not in excess of 160°C. The irradiated acid is then dissolved in water made acidic by a strong non-volatile mineral acid, and ^{131}I is separated by distillation. (A.G.W.)

28416 IMPROVEMENTS IN OR RELATING TO THE PRODUCTION OF CARBON SUB-OXIDE POLYMERS. Pierre Alexandre Gosselain, Paul Defours, and August Vrancken (to Societe Belge de l'Azote and Produits Chimiques du Marly). British Patent 985,872. Mar. 10, 1965. Filed May 24, 1962.

High molecular weight polymers (>10,000) of C_3O_2 may be produced by irradiating solutions of C_3O_2 in a halogenated hydrocarbon with γ rays, x rays, UV rays, or electron radiation from an accelerator. Preferably, a halogenated hydrocarbon such as methylene chloride, chloroform, carbon tetrachloride, ethyl bromide, or heptyl bromide is used as the solvent, and γ rays are the preferred irradiation means. Temperature and pressure exert only a weak influence on the polymerization kinetics and on the properties of the resulting polymer; however, the irradiation is advantageously carried out at a temperature in the range of −50 to +50°C. (B.L.M.)

Radiochemistry

See also Separation Processes and Procedures.

Refer also to abstracts 28346, 28738, and 29470.

28417 (AERE-M-1166) MEASUREMENT OF THE EXPOSURE DOSE-RATE FROM A SOURCE OF CHROMIUM-51. J. D. George (Research Group, United Kingdom Atomic Energy Authority, Wantage (England)). Mar. 1963. 9p. Dep.(mn).

The exposure dose rate from a source of ^{51}Cr was measured using capacitor ionization chambers. The result is compared with results obtained by other laboratories measuring similar samples. From the overall results of the intercomparison, the experimental figure for the specific gamma-ray constant (Γ) for ^{51}Cr is 0.179 r/hr/mc at 1 cm. (auth)

28418 (BNL-889) COMPUTATIONAL METHODS OF GAMMA IRRADIATOR DESIGN. B. Manowitz, R. H. Bretton, L. Galanter, and F. X. Rizzo (Brookhaven National Lab., Upton, N. Y.). Dec. 1964. Contract AT-30-2-GEN-16. 209p. Dep.; $6.00(cy), 4(mn) CFSTI.

A brief review of the principles of radiation physics is given. Analytical and empirical computation methods for determining dose distribution from gamma sources are discussed, including corrections for density, absorber thickness and air gap, boundaries, and source overlap, and the specific activity augmentation method. Irradiator design is considered for various target-source configurations. Problems illustrating calculation of design parameters, dose distributions, and uniformity ratio for given irradiator specifications are presented. Application to computation of ^{60}Co and ^{137}Cs dose distributions in practical package targets is discussed. Tables, graphs, and two computer codes — FUDGE 3A and FUDGE 4 in FORTRAN II for IBM 7094 — to aid calculations are included. (M.J.T.)

28419 (BNL-9032) TECHNETIUM-99m — PRODUCTION AND CHEMISTRY. P. Richards (Brookhaven National Lab., Upton, N. Y.). Mar. 23, 1965. Contract AT-30-2-GEN-16. 16p. (CONF-650313-1). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From Symposium on Nuclear Medicine, Philadelphia.

Technetium-99m is produced by milking ^{99}Mo. The ^{99m}Tc generator consists of a small alumina column on which the parent ^{99}Mo is adsorbed from the acid solution. Carrier-free ^{99m}Tc is eluted or milked from the column with 10-20 ml of normal physiological saline solution or 0.1 N HCl. As ^{99m}Tc is produced from the beta decay of ^{99}Mo, the generator may be re-milked as soon as sufficient Tc activity has grown in, thereby serving as a continuing source

of the short-lived nuclide. The product ^{99m}Tc solution may be sterilized by heating in a sealed vial or by filtering. ^{99m}Tc, as obtained from the generator, is in the form of the pertechnetate ion (TcO_4^-), the most stable form of the element in aqueous solutions. (P.C.H.)

28420 (NP-14825) REPORT ON THE WORK OF THE INSTITUTE OF NUCLEAR SCIENCES. Annual Report No. 4, March 1, 1961–February 28, 1962. (Inst. of Nuclear Sciences, Lower Hutt (New Zealand)). Mar. 1962. 124p. Dep.(mn).

Research work resulted in the publication of papers on previous work concerning radioactive fallout, $^{13}C/^{12}C$ age variations, tritium measurements, and ^{14}C measurements. The ^{14}C duplication equipment was installed and is in operation on a routine basis for ^{14}C ages. The old equipment is being thoroughly tested. Progress was made in construction and operation of an Ar mass spectrometer for use in radioactive well-logging. The cosmic ray equipment is functioning well. Radiation research enabled a clearer understanding of the radiolysis of aqueous H_2S, and a program of work both pure and applied was carried out using a 250-C Co source. Accelerator physics instrumenation and testing progressed to the stage where assembly of equipment, and experiments using a neutron generator will be possible next year. (J.R.D.)

28421 (NP-15052) REPORT ON THE INTERNATIONAL COMPARISON OF THE $4\pi\beta$(PC)-γ METHOD BY MEANS OF ^{60}Co, MARCH/APRIL 1963. A. Rytz (Bureau International des Poids et Mesures, Sevres (France)). Apr. 15, 1965. 36p. Dep.(mn).

Seventy-eight high-quality solid sources of ^{60}Co, each measured by C.B.N.M. and N.P.L. and one of 20 national or international laboratories, gave an excellent survey of the mutual agreement between $4\pi\beta$(PC)-γ measurements made in different parts of the world; any two laboratories measuring the same source agree in 95% of the cases within less than 0.61%; the agreement between C.B.N.M. and N.P.L. is about twice as good. The corrections to be applied to the measurements and the sources of error inherent to $4\pi\beta$-γ counting are analyzed in great detail. The decay scheme dependent correction is found to be adequately expressed by $(1-\epsilon_\beta)/\epsilon_\beta$ multiplied by a constant which has to be determined experimentally. The measurements of the specific activity of a ^{60}Co solution distributed simultaneously show a dispersion of 1.4% as compared to 3.1% obtained 14 months earlier. The presence of systematic errors due to various manipulations of solutions is highly probable. Some evidence of a systematic difference of about 0.5% as to the method used for determining the mass of the aliquot is put forward. Solid sources of the type used in this comparison might be useful standards of radioactivity during many years and should be used for evaluating the long term stability of a specified counting equipment. (auth)

28422 (UJV-1167/64) IZOMERNYE EFFEKTY PRI β-RASPADE RaE V SOSTAVE O-, M-, π-TOLIL'PROIZVODNYKH VISMUTA. (Isomeric Effects in RaE β-Decay in Bismuth o-, m-, and p-Tolyl Derivatives). V. D. Nefedov, M. Vobetski, E. N. Sinotova, and I. Vorak (Ústav Jaderného Výzkumu, Ceskoslovenská Akademie Věd, Řež (Czechoslovakia)). Jan. 1965. 5p. Dep.(mn).

Tracer bismuth (RaE) was produced by the neutron irradiation of Bi metal in a reactor. The Bi metal was dissolved in HNO_3 and treated with excess HCl to give $BiCl_3$, which was used in the synthesis of the ortho-, meta-, and para-derivatives of bismuth. The organic compounds were purified by distilling with steam followed by recrystallization from a mixture of benzene and ethyl alcohol. The decay products were allowed to accumulate in the organic compound at room temperature and were analyzed by thin-layer chromatography on Al_2O_3. The yield of Ar_3PoX compound was 67% for the ortho and para derivatives (o, p-$C_7H_7)_3Bi$, and 39% for the meta derivative (m-$C_7H_7)_3Bi$. The yield of Ar_2Po compound was 33% for the ortho and para derivatives (o, p-$C_7H_7)_3Bi$, and 61% for the meta derivative (m-$C_7H_7)_3Bi$. The rules established for organic chemical reactions are also valid for the behavior of molecular ions formed during the decay of a radioactive organometallic compound. (TTT)

28423 THE SYNTHESIS OF LABELLED MOLECULES. J. Govaerts (Universite, Liege). Acta Cient. Venezolana, 15: 229(Nov. 1964-Jan. 1965).

The preparation of radioisotope-labeled compounds is briefly reviewed. Three main methods are used for the syntheses of labeled molecules: chemical synthesis, biosynthesis, and radiochemical methods. Chemical synthesis is the most used method of preparing labeled molecules. It allows preparation of pure products in good yield. The position of the radioactive atom in the molecule is also known with certainty. This method is, however, limited particularly by the difficulty of synthesizing very complex compounds. Biosynthesis, using living organisms, permits the synthesis of the most complex molecules, but unfortunately also yields many by-products. For this reason the yields are low, and laborious purifications are necessary to obtain pure products. In the radiochemical method the radioactive atom is introduced into the molecule as the result of energy delivered by external radiation or by kinetic energy possessed by the radionuclide itself. This method is most used when it is difficult to employ one of the other two methods. (BBB)

28424 PREPARATION OF AMPHOTERICIN B-^{14}C. D. Perlman and Joan B. Semar (Squibb Inst. for Medical Research, New Brunswick, N. J.). Biotechnol. Bioeng., 7: 133-7(Mar. 1965).

Attempts were made to develop a fermentation process that would efficiently incorporate the labeled precursor into the amphotericin B, and to obtain material of high specific activity. ^{14}C-Labeled compounds were added to growing cultures of an amphotericin B-producing strain of Streptomyces nodosus maintained on various agar media. The efficiency of incorporation of labeled precursors was determined by isolation of the radioactive amphotericin B. Acetate-1-^{14}C and acetate-2-^{14}C were added to growing cultures at various times during the incubation period and the efficiency of incorporation of the radioactivity was determined. Addition of the precursor between 48 and 72 hr after inoculation resulted in high incorporation of the radioactivity. Incorporation of ^{14}C-labeled formate, propionate, methionine, and glucose was also determined; efficiency of incorporation was from 0.3 to 13.3%. Several possible reasons are advanced for the higher incorporation of acetate-2-^{14}C into amphotericin as compared with acetate-1-^{14}C. The specific activity of the crude amphotericin B recovered from fermentation supplemented with acetate and propionate precursors at a level of 1 μC/ml ranged from 10 to 25 μC/g. (TCO)

28425 HIGH-PRECISION 4π LIQUID SCINTILLATION COUNTING. R. Vaninbroukx and A. Spernol (Euratom, Geel, Belg.). Intern. J. Appl. Radiation Isotopes, 16: 289-300(May 1965).

A precise method for determination of the absolute activity of radioactive solutions by liquid scintillation counting is described. The method is based on the extrapolation of the integral spectrum to zero energy. The reproducibility for α- and for β-emitters with a maximum energy higher than 150 kev was generally considerably better than ±0.2%. The results obtained with this method agreed within less than ±0.5% with those obtained by other methods. (auth)

28426 AN AUTOMATICALLY CONTROLLED WASHING PROCEDURE FOR ^{132}I GENERATORS. John R. Howley (Dept. of Health, Education, and Welfare, Bethesda, Md.). J. Nucl. Med., 6: 220-2(Mar. 1965).

A system is presented for controlling iodine-131 contamination of the Brookhaven type ^{132}I generator. To facilitate the ammonium hydroxide eluting process used to remove ^{131}I and ^{132}I from the generator, an automatically controlled procedure was tested. The system was found to reduce ^{131}I contaminants in the ^{132}I from initial levels of 2 or 3 percent down to levels <0.005 percent. (H.G.D.)

28427 ADSORPTION OF TRACE AMOUNTS OF RADIOACTIVE ANIONS AND CATIONS ON Al SURFACES. Elwira Herczynska and Krystyna Proszynska (Inst. of Nuclear Research, Warsaw). Nukleonika, 10: 95-106(1965).

The adsorption of $^{137}Cs^+$, $^{45}Ca^{2+}$, H^+, OH^-, $^{131}I^-$, $^{35}S-SO_4^{2-}$, and $^{32}P-PO_4^{3-}$ on Al powders was determined by potentiometric and radiometric methods. The aim was to continue, enlarge, and verify the results obtained in previous works concerning the adsorption of ions on various metal and oxide surfaces as a function of pH and the concentration of the solution. The form of the adsorption isotherms is proposed and some calculations were performed. (auth)

28428 PREPARATION OF ^{59}Fe WITHOUT CARRIER. I. Galateanu, G. Fodor, C. Chiotan, and M. Cristu. (Institut de Physique Atomique, Académie de la R. P. R., Sos Măgurele, Rumania). Rev. Roumaine Chim., 9: 601-10 (1964). (In French)

A method for obtaining carrier-free ^{59}Fe of high purity for medical purposes is presented. The isotope was formed by irradiation of metallic Co or its chloride with fast neutrons. Studies of separation of artificial mixtures of the metals in which the ratio (Co : Fe) ranged from 10^4 to 2 were made with ^{60}Co or $^{55}Fe-^{59}Fe$ were used as tracers; Fe extraction was studied with acetylacetone, tributyl phosphate, ethyl ether, and isopropyl ether. Extraction of Fe by the ethers was found most satisfactory, and since isopropyl ether extracts more (80%) for a single step than ethyl ether, it was used for the procedure. To avoid Co in the organic phase, it was saturated with 8M HCl before use. The extraction is most efficient for 8-9M HCl. Anion exchange of artificial mixtures in 10M HCl using Dowex-1, 100-200 mesh, HCl form, 250 mm length, 1 ml/min for setting up the column was examined. Removal of Co was effected with 4.5M HCl, 0.7-0.9 ml/min, 60 ml. Elution of Fe followed with 0.125M HCl, 0.7-0.9 ml/min, 40 ml. The suggested procedure combines both procedures. Samples (4 g) of $CoCl_2 \cdot 6\,H_2O$ were irradiated 48-100 hours, dissolved in 100 ml 8M HCl, extracted twice with 150 ml isopropyl ether saturated with 8M HCl after stirring 15 min together, the organic phase combined with 20 ml 8M HCl and distilled in vacuo. The aqueous phase was put onto a column (85 ml 8.4M HCl) and the ions were separated using 85 ml 4.5M HCl and 80 ml 0.125M HCl, yielding ^{59}Fe pure by gamma spectrometry. (BBB)

28429 COMPOUNDS LABELED WITH STABLE ISOTOPES. II. INVESTIGATION OF THE SKRAUP QUINOLINE SYNTHESIS WITH THE HELP OF ^{15}N. M. Wahren (Institut fur Stabile Isotope, Deutsche Akademie der Wissenschaften, Leipzig). Tetrahedron, 20: 2773-80(Dec. 1964). (In German)

Nitrobenzene-^{15}N was prepared from benzene, $Na^{15}NO_3$, and sulfuric acid. Fifty g $NaNO_3$ (8.1% ^{15}N) and 30 ml H_2O were cooled and 150 ml concentrated H_2SO_4 added. Forty ml benzene were dropped in and afterwards the mixture was refluxed 45 min on a steam bath. The nitrobenzene was carefully separated from the acid and salt mixture, washed with H_2O, dilute NaOH, then H_2O, and dried with $CaCl_2$. Distillation gave 51 g nitrobenzene-^{15}N. From the nitrating mixture 6 g $(^{15}NH_4)_2SO_4$ were recovered after reduction. The nitrobenzene was converted to aniline, which was used to study the origin of N in the Skraup quinoline synthesis. A procedure was developed to separate and analyze nitrobenzene, aniline, quinoline, resin, and residue, the products of the reaction. The N was analyzed as N_2 mass spectrometrically. Samples were prepared containing nitrobenzene, aniline, glycerine, and concentrated H_2SO_4 with either nitrobenzene or aniline labeled, and with varying amounts of the latter two components relative to the first. Less than 2% of the quinoline N comes from the nitrobenzene N; more than 90% of labeled nitrobenzene appears in the resin and nitrobenzene fractions of the product; the resin product contains N in a higher oxidation state than the amino stage. Thus unsubstituted nitrobenzene or m-nitrobenzenesulfonic acid may be used in the preparation of labeled substituted quinolines. (BBB)

28430 SYNTHESIS OF RADIOACTIVELY LABELED COMPOUNDS. XII. SYNTHESIS OF NICOTINIC ACID (4, 6-^{14}C, AND N-METHYL-3-CARBOXY-6-PIPERIDONE-(4,6-^{14}C). D. Gross, A. Feige, and H. R. Schuette (Institut fur Biochemie der Pflanzen, Deutsche Akademie der Wissenschaften, Halle-Saale, Ger.). Z. Chem., 5: 21(1965). (In German)

Quinoline-(2,4-^{14}C) was prepared by the Skraup synthesis from glycerine-(1,3-^{14}C) and aniline hydrochloride by $FeSO_4$ in nitrobenzene. The residue of the ether extract from workup of this material was used directly to prepare nicotinic acid-(4,6-^{14}C); the quinoline was oxidized with Se in concentrated H_2SO_4, 5 hours at reflux (260-280°C). After cooling, diluting, bringing to pH 3.6, and extracting with n-butanol, the extract was evaporated to dryness and sublimed. This was methylated with $(CH_3)_2SO_4$ at 130°C for 4 hours, diluted with dilute H_2SO_4, and reduced in volume in a N_2 stream at 70°C. Ethanol was added and the trigonellin sulfate separated on cooling. It was washed with ethanol and ether. This was oxidized in 2.5 N NaOH with a 32% $K_3Fe(CN)_6$ solution added over 10 minutes. After standing one hour the pH was adjusted to 3.5 and on cooling, the pyridone separated; it was washed with a little water and dried in air. This was converted to the piperidone by hydrogenation with Pt (PtO_2) in methanol at room temperature. The product was isolated by evaporation of the methanol after removal of the catalyst and was recrystallized from butyl acetate. (BBB)

28431 INVESTIGATION OF THE "SHAKING" OF THE ELECTRON SHELLS OF ORIENTED MOLECULES CONTAINING P^{32}. E. E. Berlovich, L. M. Kutsentov, and V. G. Fleisher (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksperim. i Teor. Fiz., 48: 1013-21(Apr. 1965). (In Russian)

The ionization of the outer electron shells of oriented organic molecules containing ^{32}P produced as a result of β decay is studied. The slow electrons emitted from a monomolecular source were recorded directly. The external ionization effect produced by the β particles in the source can be singled out by investigating the slow electron yield as a function of the angle of emission of the β particles relative to the normal to the surface of the source. The lower limit of yield of ionization electrons from the valency shell of monoacetyl phosphate is estimated to be 28% per β decay. By replacing the hydroxyl hydrogen in these molecules by mercury, a correlation was found to exist between the ionization probability and mean momentum component of the recoil nucleus at an angle of 60° with respect to the molecule axis. Both quantities vary in a similar manner with variation of the β particle energy. The largest ionization contribution depending on the β particle energy is observed when the β particles are emitted perpendicular to the direction of orientation of the molecules and comprises 0.3 ± 0.05 of the total ionization probability for the hard part of the β spectrum. Thus along with shaking of the shell due to nonadiabatic change of the nuclear charge on β particle emission and which is independent of the particle energy, an ionization is observed which depends on the velocity of the recoil nucleus. (auth)

28432 ISOTOPE EFFECTS AND THEIR SIGNIFICANCE. P. Baertschi (Eidgenossisches Institut für Reaktorforschung, Würenlingen, Switzerland). Z. Naturwiss. Med. Grundlagenforsch., 2: 22-42(June 1964). (In German)

A survey was made on the origin and significance of some important isotope effects, especially those occurring in chemical reactions. A table of isotope effects on physical constants of H_2O and D_2O is presented. The origin of chemical isotopes is presented in terms of the energy well for HCl; this treatment is extended to include the position of isotopic equilibrium constants. Several examples are presented in tabular form. Isotope effects in common chemical equilibria and the results of these effects are discussed, with emphasis on tracer techniques, atomic weights, iso-

topic separation, and isotopic geology. Isotopic effects on chemical reaction rates are developed in terms of potential energy curves for the reaction A + H − B ⇌ A − H + B, so that the maximum kinetic isotope effect for rupture of several M−H bonds may be calculated; a few of the latter are tabulated for various temperatures. Examples of determination of reaction mechanisms are given, and a table of maximum kinetic isotope effects for pairs of heavier atoms is presented. A brief section is included for the effects of isotopic nuclear moment on spectra of a few elements. Finally, a few illustrations of applications of these methods to biochemical systems are given, and recent results on the behavior of life upon substitution of H by D are reviewed. (BBB)

28433 EFFECT OF THE STRUCTURE OF ALCOHOLS ON THEIR DEHYDRATION OVER RADIOACTIVE MAGNESIUM SULFATE. Vikt. I. Spitsyn, I. E. Mikhailenko, and O. M. Petrova (Inst. of Physical Chemistry, Academy of Sciences, USSR). Zh. Fiz. Khim., 39: 478-81(Feb. 1965). (In Russian)

The radioactive emission of the isotope ^{35}S, introduced in magnesium sulfate, alters the catalytic activity of $MgSO_4$. The ionizing β emission of ^{35}S affects the adsorbed molecule of alcohol on the surface of the catalyst, causing its polarization, the size of which depends on the composition of alcohol. (tr-auth)

28434 IMPROVEMENTS IN OR RELATING TO THE MANUFACTURE OF BREMSSTRAHLUNG SOURCES. John Douglas Ault (to Saunders-Roe and Nuclear Enterprises Ltd.). British Patent 985,286. Mar. 3, 1965. Filed Sept. 8, 1962.

A source of bremsstrahlung radiations is formed by intimately mixing radioactive isotope material and target material and bonding and encapsulating the mixture. The intimate mixture is produced by precipitating the radioactive material from a liquid solution in a suspension of the target material in a liquid, then separating the precipitate and the suspension from the liquid. Alternatively the target material may be precipitated and the radioactive material suspended or both may be precipitated together. Any radiation-resistant materials may be used for the bonding and encapsulating process. (A.G.W.)

Separation Processes and Procedures

See also Analytical Procedures.

Refer also to abstract 28784.

28435 (AE-183) MECHANICAL AND INSTRUMENTAL EXPERIENCES FROM THE ERECTION, COMMISSIONING, AND OPERATION OF A SMALL PILOT PLANT FOR DEVELOPMENT WORK ON AQUEOUS REPROCESSING OF NUCLEAR FUELS. K. Joensson (Aktiebolaget Atomenergi, Stockholm (Sweden)). May 1965. 25p. Dep.(mn).

A radiochemical pilot plant for the reprocessing of irradiated nuclear fuels has been built at Kjeller in Norway. A short description of the main equipment is given as well as of the procedure during the erection of the plant. Finally the results and experiences from the cold tests, tracer tests, and active runs are indicated. (auth)

28436 (AERE-R-4440(Pt.I)) REPROCESSING WITH AMINE-ETHER SYSTEMS. PART I. CHOICE OF SOLVENT SYSTEM. E. S. Lane, A. Pilbeam, and J. M. Fletcher (Atomic Energy Research Establishment, Harwell (England)). Apr. 1965. 22p. Dep.; $0.70(BIS), 3s. 6d. (HMSO).

The tertiary amine, Alamine 336, and the ether diluent, dibutyl cellosolve, were selected for further study with an outline flowsheet by which plutonium would be separated from the uranium and fission products contained in an irradiated fast reactor fuel. Some properties of the organic phases produced after equilibration with aqueous nitric acid were determined for the amine and ether separately, and also as a 15% v/v mixture of the amine in the ether. The properties examined have included (i) degradation by heat and irradiation and (ii) third phase formation. (auth)

28437 (BM-RI-6635) EXTRACTION OF TANTALUM AND COLUMBIUM FROM ORES AND CONCENTRATES BY CHLORINATION. S. L. May and G. T. Engel (Bureau of Mines, Albany, Oreg. Albany Metallurgy Research Center). Oct. 1964. 10p. Free (Bureau of Mines).

Tantalum and niobium can be extracted from several of their ores or concentrates by chlorination procedures. Direct chlorination of high-grade minerals in the presence of carbon at temperatures between 500 and 800°C will extract up to 99 percent of the tantalum and niobium. Metallurgical beneficiation of low-grade source materials by carbothermic reduction produces a ferroalloy that is amenable to chlorination at a temperature of 500°C. Over 90 percent of the tantalum and niobium can be recovered. (auth)

28438 (EUR-2297.e) PHYSICO-CHEMICAL RESEARCH ON THE TRANSPLUTONIUM ELEMENTS. F. Caligara, Ph. Dreze, G. Duyckaerts, J. Fuger, J. Goffart, and W. Mueller (Liège Univ. (Belgium)). 1965. 58p. Dep.(mn).

Results are summarized for the following studies: (1) trilaurylamine in hydrochloric acid medium, (2) extraction of lanthanides and actinides with alkyl phosphine oxides, (3) extraction of lanthanides and actinides with di-n-butyl phosphoric acid, and (4) electrochemical studies in molten salts. (D.L.C.)

28439 (IDO-14648) SOLIDS FLOW CONTROL FOR A PULSED SOLIDS-LIQUID CONTACTOR. Earl S. Grimmett and Noel de Nevers (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.). Mar. 1965. Contract AT(10-1)-205. 48p. Dep.; $3.00(cy), 1(mn) CFSTI.

A solids transport and control system was developed for a pulsed solids-liquid contactor. The system consists of a constant-flow-rate slurry feeder to feed the solids into the contactor and a constant-inventory slurry feeder to withdraw the solids from the contactor, both of which employ a fluidized bed for introduction of solids and a slurry gas lift to move the solids from the bottom of one contactor to the top of another. The entire system has been operated satisfactorily over a wide range of conditions circulating Dowex-50 ion-exchange resin. (auth)

28440 (IDO-14652) INSTRUMENTATION AND CONTROL PRACTICES IN U.S.A. REPROCESSING PLANTS. L. A. Jobe (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.). Apr. 1965. Contract AT(10-1)-205. 30p. Dep.; $2.00(cy), 1(mn) CFSTI.

Instrumentation and control practices at the Hanford Plant, the Idaho Chemical Processing Plant, the Oak Ridge National Laboratory, and the Savannah River Plant are surveyed. Process variables are grouped, and the instruments which have been developed for use in measuring and controlling these variables are tabulated. Included in this tabulation are instruments for both in-line analytical and direct or inferential measurements. Several control loops are discussed from the systems engineering standpoint. The use of data loggers and computers is discussed briefly. (auth)

28441 (NIJS-R-440) EXTRACTION OF SOME LANTHANIDES WITH SEVERAL ORTHOPHOSPHORIC ACID ESTERS. F. Krasovec and C. Klofutar (Nuklearni Institut "Jozef Stefan," Ljubljana (Yugoslavia)). Nov. 1964. 16p. Dep.(mn).

The extraction Y(III) and some trivalent lanthanide ions from 1 molar (H,Na)ClO_4 aqueous phase with chloroform solutions of several phosphoric acid esters was studied. The results indicate that $MA_3(HA)_2$ is the predominant complex extracted with aromatic esters of phosphoric acid, while with aliphatic di-n-butyl phosphate $MA_3(HA)_3$ is the complex existing in the organic phase. The formation of the former complex can be alternatively written by following reactions: $M^{3+}(aq) + 3\ A^-(aq) + 2HA(org) \rightleftharpoons MA_3(HA)_2(org)$

and $M^{3+}(aq) + 2.5\ H_2A_2(org) \rightleftharpoons MA_3(HA)_2(org) + 3\ H^+(aq)$. The equilibrium constants K_3 and K_5 of those reactions were calculated. It was observed that a linear relationship between log K_3 and log $K_d \cdot K_2^{-1}$ exists. With the aid of this relationship an emperical equation was derived enabling to predict the efficiency for the extraction of trivalent lanthanides of any aromatic ester of orthophosphoric acid if its acid dissociation (K_a), distribution (K_d), and dimerization (K_2) constants are known. The results further show that a high extraction efficiency will be exhibited by phosphoric acid esters having a high acid dissociation and distribution constant and a low dimerization constant. (auth)

28442 (NP-14945) FINAL PLUTONIUM PURIFICATION BY TLA EXTRACTION AND DIRECT PRECIPITATION FROM THE ORGANIC PHASE. STUDY AND DEVELOPMENT OF THE CHEMICAL PROCESS AND OF CONTINUOUS PRECIPITATION EQUIPMENT. G. Rolandi, J. van Geel, and A. Geoffroy (European Company for the Chemical Processing of Irradiated Fuels, Mol (Belgium)). June 1964. 59p. (ETR-167). Dep.(mn); $3.00(cy), 2(mn) CFSTI.

After a brief historical outline of the progress of the study since ETR-134, an account is given of recent work carried out at Eurochemic on the TLA-Direct Precipitation Process for final plutonium purification. The 20% TLA in Solvesso-100 system was retained for extraction. Equilibrium data for plutonium and uranium extraction in this system as well as decontamination factors obtained during flowsheet testing in laboratory mixer settlers are presented and discussed. The results of the study of chemical conditions for direct plutonium precipitation are also given. In addition, the characteristics of a continuous subcritical precipitator, specially developed for the direct precipitation, are described, as well as the first results obtained with this equipment. Finally, the principles of the proposed flowsheet for the combined TLA-Direct Precipitation Process are presented. (auth)

28443 (ORNL-3785) CHEMICAL TECHNOLOGY DIVISION, CHEMICAL DEVELOPMENT SECTION C STATUS AND PROGRESS REPORT ON SEPARATIONS RESEARCH AND DEVELOPMENT. K. B. Brown (Oak Ridge National Lab., Tenn.). Apr. 1965. Contract W-7405-eng-26. 186p. Dep.; $5.00(cy), 4(mn) CFSTI.

A project was initiated for separation and recovery of biologically important macromolecules. Attention was initially directed toward methods of recovering mixed transfer-ribonucleic acids from E. coli bacteria. A satisfactory procedure was devised, involving the use of phenol to break the cells, isopropanol fractionation to remove deoxyribonucleic acids from the ribonucleic acids, and DEAE-cellulose chromatography to separate the transfer-ribonucleic acids from other ribonucleic acids. Testing confirmed the utility of the phenol extraction process for recovering Cs from alkaline ore leach liquors. Emphasis was on recovering Cs from pollucite ore. Tests of uranyl recovery by tri-n-octylphosphine oxide on microporous polyethylene are reported which show advantages from sorption by immobilized extractants. The stabilities, Soltrol 170 and Peneteck White Oil, against nitric acid degradation were improved by treating them with concentrated sulfuric acid. Adogen 382 (triisodecylamine) showed high U-extraction power from sulfate liquors. Maximum coefficients for extractions of metal ions from HCl and LiCl-0.2 M HCl (0.5 to 10 M in total chloride) solutions with representative primary, secondary, tertiary, and quaternary amines (0.1 M) in diethylbenzene were obtained for Tc(VII), Ag(I), Cd(II), Pd(II), Sn(IV), Sb(V), Au(III), Hg(II), Tl(I), Po(IV), and U(VI) in excess of 1000. Maximum coefficients ranging from 10 to 1000 were obtained for In(III), Sb(III), Te(IV), Te(VI), Ta(V), W(VI), Re(VII), Os(IV), and Bi(III). Metals with maximum extraction coefficients in the range of 0.1 to 10 included Zr(III), Hf(IV), Pb(II), and Th(IV). Maximum coefficients were less than 0.1 for Li, Na, K, Cs, Be, Mg, Ca, Ba, Al, La, and Eu. With most metals, the extraction power varied in the order: Aliquat 336 (quaternary) ≥ Alamine 336 (tertiary) > Amberlite La-1 (secondary) ≫ Primene JM (primary). Measurements of extraction of Cs from lighter alkali metals using BAMBP showed an inverse first-power dependence of the extraction coefficient on acid concentration in the pH range 7.6 to 10.6, and a third-power reagent dependence at 0.1 to 1 M. Loading data indicated a mole ratio of Cs : BAMBP of 1 : 4 in the organic phase. Isopiestic and vapor-pressure depression determinations of the apparent average polymerization numbers of BAMBP (4-sec-butyl-2-(α-methyl-benzyl)phenol) showed little polymerization in dry $CHCl_3$ ($\bar{n}$ = 1.2 at 0.77 m ≈ 0.9 M) and dry toluene ($\bar{n}$ = 1.0 at 0.41 m ≈ 0.3 M), more polymerization in water-saturated CCl_4 ($\bar{n}$ = 1.6 at 0.8 m ≈ 1.0 M), and high polymerizations in n-hexane, $\bar{n}$ increasing from 1.5 at 0.23 m to 2.8 at 2.4 m ≈ 1.1 M (dry) and to 3.4 at 2.3 m (water activity = 0.9). Multiple equilibria in the synergistic extraction of Cs by BAMBP-acid mixtures are indicated by results of measurements of distribution, infrared absorption, and nuclear magnetic resonance. The activity coefficients of triphenylmethane, were determined by the direct measurement of vapor-pressure lowering over benzene solutions at 26°C through a concentration range up to 0.330 m (γ_{TPM} = 0.74). Activity coefficients of azobenzene and trioctylamine were evaluated by isopiestic balancing against triphenylmethane at 25°C. Dipole moments for phosphate extractant species in n-octane were determined at ~0.005 to 0.5 M. A direct comparison of glass-electrode pH with quinhydrone-electrode potential in $NaNO_3$ showed that a linear relation exists. (J.R.D.)

28444 (ORNL-TM-1094) CHEMICAL TECHNOLOGY DIVISION, UNIT OPERATIONS SECTION MONTHLY PROGRESS REPORT, FEBRUARY 1965. M. E. Whatley, P. A. Haas, R. W. Horton, A. D. Ryon, J. C. Suddath, and C. D. Watson (Oak Ridge National Lab., Tenn.). May 1965. Contract W-7405-eng-26. 30p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

The flow capacity and stage efficiency of a single-stage mixer settler have been determined for recovery of cesium from Purex 1WW using 1 M BAMBP in Amsco and stripping with dilute HNO_3. The capacity at flooding was 290 gal hr^{-1} ft^{-2} for extraction and 730 for stripping. Greater than 90% stage efficiency was easily attained for both extraction and stripping. Studies of continuous oxidation of graphite by oxygen in pressurized 1-2 molar nitric acid were continued. The reaction rates increased with increased nitric acid concentration, temperature, and agitation. Partial pressure of oxygen and external surface area of the graphite were less important. Waste calcination test R-88 was a rising level glass run using FTW-65 × 3 simulated Purex waste modified with lithium phosphate. A continuous feed rate of 10 liters/hr was sustained during the 64-hr test. The glass product appeared to have acceptable physical properties except for a layer of unfused solids at the top of the pot. (auth)

28445 (UJV-1168/64) ISSLEDOVANIYA KHROMATOGRAFICHESKOGO POVEDENIYA NEKOTORYKH TELLURORGANICHESKIKH SOEDINENII V TONKIKH SLOYAKH OKISI ALYUMINIYA. (Investigation of Chromatographic Behavior of Certain Organic Tellurium Compounds in Thin Aluminum Oxide Layers). M. Vobetski, V. D. Nefedov, and E. N. Sinotova (Ústav Jaderného Výzkumu, Československá Akademie Věd, Řež (Czechoslovakia)). Jan. 1965. 9p. Dep.(mn).

Unsupported Al_2O_3 layers 0.4 mm thick inclined at an angle of 15° were used to separate various organic tellurium compounds. With petroleum ether as a developing agent, the R_F values (given in parentheses) were determined with an accuracy of ±0.02 to 0.03 for the following diaryl derivatives of tellurium: (o- $CH_3C_6H_4)_2Te$ (0.61), (m- $CH_3C_6H_4)_2Te$ (0.54), (p- $CH_3C_6H_4)_2Te$ (0.54), (p-$(CH_3)_2$ $C_6H_3)_2TE$ (0.62, (p-$CH_3O.C_6H_4)_2Te$ (0.54), (α-$C_{10}H_7)_2Te$ (0.33), $(C_6H_5)_2O$ (0.59), $(C_6H_5)_2S$ (0.60), $(C_6H_5)_2Se$ (0.58), and $(C_6H_5)_2Te$ (0.56). Compounds showing a difference in R_F values can be readily separated from each other. It was also found that compounds of the type Ar_2TeCl_2 can be readily separated from compounds of the type Ar_3TeCl

with the use of mixtures of benzene–ethanol or of ethyl-acetate–methanol as developing agents. (TTT)

28446 (USNRDL-TR-816) NEAR-SYMMETRIC FISSION-IDENTIFICATION AND YIELD OF Cd^{121}. H. V. Weiss (Naval Radiological Defense Lab., San Francisco, Calif.). Feb. 1, 1965. Contract AT(49-2)-1167. 12p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Evidence was acquired for the formation of ^{121}Cd in the thermal neutron fission of ^{235}U. Its half-life and cumulative fission yield are 12.8 sec and $(6.4 \pm 0.5) \times 10^{-3}\%$, respectively. From the cumulative fractional chain yield a value of 48.45 was inferred for the most probable nuclear charge (Z_p) of the primary fission fragment formed in this chain. The addition of this value to a partially formulated empirical Z_p function suggests that the value of Z_p proceeds toward the point of symmetrical fission by a gentle rather than abrupt approach. The mass 121 chain yield was redetermined and the value obtained was $(1.2 \pm 0.1) \times 10^{-2}\%$. This value is based on a measured cumulative yield of $(1.1 + 0.01) \times 10^{-2}\%$ for ^{121}Sn (27.5h) and a literature value of $0.08 \times 10^{-2}\%$ for ^{121m}Sn (25y). (auth)

28447 ON THE STUDY OF THE ADSORPTION OF RADIOISOTOPES ON GLASS. Petr Beneš (CVUT, Prague). Chem. Listy, 59: 328-30(1965). (In Czech)

A suitable modification of a method for study of the adsorption of radioisotopes on glass is described. It consists in the adsorption of the radioisotopes on the interior surfaces of glass ampules. The advantages and disadvantages of the modification were discussed. (tr-auth)

28448 SORPTION OF RADIOACTIVE ISOTOPES ON PRECIPITATES. XIII. SORPTION PROPERTIES OF IRON(III) HYDROXIDES IN THE PRESENCE OF PHOSPHATES. Z. Kolarik and J. Krtil (Inst. for Nuclear Research, Czechoslovak Academy of Sciences, Rez). Collection Czech. Chem. Commun., 30: 724-36(Mar. 1965). (In German)

The sorption of phosphate ions on iron(III) hydroxide was radiometrically followed and its dependence on phosphate and hydrogen ion concentration determined. The effect of the phosphate ions on the sorption of Cs, Sr, and Ce(III) ions on iron(III) hydroxide was investigated. The mechanism of the anion exchange and the cation exchange in the presence of phosphate ions and the composition of the iron(III) phosphate is discussed. (tr-auth)

28449 THE SORPTION OF RADIOACTIVE ISOTOPES ON PRECIPITATES. XIV. ZIRCONIUM SORPTION ON SILICA GEL IN THE PRESENCE OF PHOSPHORIC ACID. J. Krtil and Z. Kolarik (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Rez.). Collection Czech. Chem. Commun., 30: 824-32(Mar. 1965). (In German)

The sorption of ^{95}Zr on silica gel in the presence of phosphoric acid and/or iron(III) ions was studied. In the concentration range from 0.002 to 0.3 M, the phosphoric acid essentially increased the sorption of ^{95}Zr on the silica gel. Under these conditions, the zirconium sorption in the form of electroneutral phosphate complexes probably occurred through the mechanism of molecular sorption. Iron(III) ions alone did not affect the sorption of ^{95}Zr on silica gel, but in the presence of phosphoric acid they decreased the sorption sharply. (tr-auth)

28450 CHEMICAL SEPARATIONS IN THE DETERMINATION OF FISSION YIELDS. S. Fredric Marsh and Robert E. Foster, Jr. (Phillips Petroleum Co., Idaho Falls, Idaho). Trans. Am. Nucl. Soc., 8: 12(May 1965).

28451 REMOVAL OF RARE-EARTH FISSION PRODUCTS FROM MOLTEN-SALT REACTOR FUELS BY DISTILLATION. M. J. Kelly (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 170(May 1965).

28452 DESIGN OF A CHOP AND LEACH REPROCESSING PLANT FOR THE JAPANESE ATOMIC FUEL CORPORATION. Donald E. Bloomfield, Chester S. Ehrman, and L. K. Vassil (American Machine and Foundry Co., York, Pa.). Trans. Am. Nucl. Soc., 8: 171-2(May 1965).

28453 THE THERMODYNAMICS OF EXCHANGE ADSORPTION. III. AN EXPERIMENTAL CONTRIBUTION TO THE THERMODYNAMICS OF THE SWELLING OF WEAKLY ACID CATION EXCHANGERS. K. Gaertner and J. Giesemann (Technische Hochschule, Merseburg, Ger.). Z. Physik. Chem. (Leipzig), 228: 129-38(1965). (In German)

Thermodynamic functions were calculated from isopiestic and calorimetric measurements for the swelling process of a weakly acid ion exchanger (Wofatit CP). The isothermal calorimeter used for determination of the swelling enthalpy is described. From the differential modifications of the thermodynamic functions it was concluded that in the H^+ form essentially only the COO^- group was hydrated, whereas in the Na^+ form the largest part of the water taken up was bound to the cations. (tr-auth)

28454 EXTRACTION OF RARE EARTHS BY PHENYLBUTYLPHOSPHATES. V. P. Shvedov and Yu. F. Orlov (Inst. of Tech., Leningrad). Zh. Neorgan. Khim., 10: 693-6 (Mar. 1965). (In Russian)

The extraction of Ce(III) and Pr abruptly decreased in the series TBP, dibutylphenyl phosphate (DBPP), and diphenylbutyl phosphate (DPBP) but the coefficients of partition remained practically constant. During extraction with DBPP the values of the partition coefficients of the element pairs $La-Ce^{3+}$ and Pr–Nd differed from the values obtained earlier in the extraction of rare earths with TBP. (tr-auth)

28455 IMPROVEMENTS IN OR RELATING TO RADIOACTIVE MATERIALS EXTRACTION PROCESSES. Geoffrey James Chetewoode Nash (to United Kingdom Atomic Energy Authority). British Patent 985,400. Mar. 10, 1965. Filed Dec. 30, 1960.

A process and apparatus are described for the extraction of volatile radioactive isotopes of the elements having atomic numbers 38, 51, 52, 53, 55, or 56 in aerosol form from a stream of carrier gas. The apparatus includes a duct connected to a source of isotopes in vapor phase, a bed of extractant material in the flow path, and means for introducing the natural form of the element upstream of the extractant material. A plurality of dispensers are provided outside the duct and each is arranged to supply a vapor of the natural isotope of the different elements in the duct to effect exchange of the natural and radioactive isotopes. A bed of active charcoal serves as the extractant. (B.L.M.)

28456 PROCESS AND APPARATUS FOR THE SEPARATION OF GASEOUS ISOTOPES. Walter Dobner. British Patent 985,668. Mar. 10, 1965. Filed June 14, 1961.

A process and apparatus are reported for the separation of a mixture of gaseous isotopes of various molecular weights into its components. The process consists of intermittently directing volumes of the mixture at high speed into a longitudinally confined channel between an inlet and outlet, evacuating the speeding light isotopes of each volume from the channel through the outlet, interrupting communication between the channel and the outlet, and then evacuating the remaining heavy isotopes. The mixture is directed into the channel having a depth twice as great as its width at a pressure of up to 10 atm. The evacuation of the speeding light isotopes occurs at pressures down to 0.0001 atm, and the channel can be driven at a speed of rotation that is controllable between 1000 and 10,000 rpm. (B.L.M.)

28457 IMPROVEMENTS IN OR RELATING TO HAFNIUM EXTRACTION. Alain De Calmes, Henri Humeau, and Alfred Lecocq (to Commissariat à l'Énergie Atomique). British Patent 986,294. Mar. 17, 1965. Priority date Dec. 27, 1961, France.

A process is described for the recovery of Hf by solvent extraction from aqueous solutions, particularly from solutions from a Zr extractor that contain about 20% Hf. The solution is concentrated and acidified. If the acidification is carried out at ordinary temperature, HNO_3 may

be used, but some other acids require heat. In order to eliminate the major part of the impurities, the solution is shaken for a short time with an organic solvent. A solution of TBP diluted with a mixture of petroleum hydrocarbons gives best results. The emulsion formed is allowed to separate into two clear phases separated by a sludge inter-layer that contains the major part of the impurities. The upper organic phase contains almost all the Hf and all the Zr. The lower aqueous phase contains the rest of the Hf and can be recycled to the previous stage in the process. The sludge is rejected after the recovery of the solvent. The operation is applicable to solutions containing 4 to 60 g/l of ZrO_2 and 1 to 20 g/l of HfO_2. (B.L.M.)

28458 SOLVENT EXTRACTION OF METALS. (to Petrolite Corp.). British Patent 986,674. Mar. 17, 1965. Priority date Nov. 4, 1960, United States.

A process for the solvent extraction of metals is reported in which the mixture of extract and raffinate phases is subjected to the action of one or more high-voltage unidirectional electric field. Various methods are described for conditioning the pregnant organic solution for the main electric treatment. The conductivity of the conditioned mixtures range from about 10^{-7} to 10^{-8} mhos/cm. This process can be employed in variations on known metal extraction processes to obtain greater purity of metals and to purify organic solvents employed in extraction processes. (B.L.M.)

28459 A PROCESS FOR THE REMOVAL OF IMPURITIES FROM ACTINIDES. (to Institutt for Atomenergi). British Patent 987,651. Mar. 31, 1965. Priority date May 8, 1962, Norway.

In a process for the removal of impurities from actinides, a complexing agent is added to an actinide-containing substance in acid solution to form water-soluble complexes of the actinides while the impurities remain in uncomplexed form. Utilizing the difference in molecular size between the complexed actinides and the uncomplexed impurities, separation is achieved by either molecular filtration or electrodialysis. The complexing agent must contain polar groups such as hydroxy, ester, ether, keto, or carboxy. Molecular sieves used for the molecular filtration are made of acid resistant microporous material having a pore diameter between 6 and 12 Å. If fission products are removed from solutions of irradiated fuels by the method, the fission products may be removed in solid condition for storage or further treatment by replacing the initial molecular sieve with another when a desired amount of fission products has been fixed by sorption. If electrodialysis is used for the separation, a microporous diaphragm of a pore diameter of 6 to 12 Å is used. (B.L.M.)

28460 PROCESS FOR LIXIVIATING URANIUM-BEARING ORES WITH A DILUTE ALKALINE SOLUTION. Pierre Mouret, Paul Pottier, and Alban Villa (to Commissariat à l'Énergie Atomique). Canadian Patent 684,770. Apr. 21, 1964. Priority date June 29, 1959, France.

A process is described for leaching broken and coarsely crushed uranium ore with a dilute alkaline carbonate and/or alkaline bicarbonate solution at ambient temperature. The solution is sprayed on the ore containing less than 1000 ppm uranium at a rate of 0.5 to 5 l/hr per m^2 of ore surface for periods of one month to several years. The process is applicable to treatment of ores in large bins or heaps exposed to the weather. After leaching, a drainage system collects the uranium-bearing liquor and leads it for extraction into a small mobile chemical-treatment unit. (B.L.M.)

28461 METHOD OF REPROCESSING AQUEOUS SOLUTIONS OF IRRADIATED REACTOR FUELS. Cleve Richard Anderson (to General Electric Co.). German Patent 1,184,745. Jan. 7, 1965. Priority date July 26, 1962, [United States].

The method comprises the steps of extracting the solution of irradiated nuclear fuel with an organic solvent, of dehydrating the aqueous extract obtained that contains uranium and at least one of the fission products ruthenium, zirconium, and niobium, of fluorinating the solid substances free from water, and of separating the uranium fluoride from the fluorides of the fission products that have a higher boiling point. (Gmelin Inst.)

28462 POTASSIUM PLUTONIUM SULFATE SEPARATION PROCESS. Michael Cefola (to U. S. Atomic Energy Commission). U. S. Patent 3,154,375. Oct. 27, 1964. Filed July 2, 1947.

The potassium plutonium sulfate separation process is modified to permit precipitation of potassium plutonium sulfate from a solution containing less than 10% by weight of potassium sulfate. The modification consists of addition of 10 to 50% by weight of a monohydroxy alcohol containing not more than three carbon atoms to the aqueous solution from which the potassium plutonium sulfate is to be precipitated. The digestion temperature of the solution is kept slightly below the boiling temperature of the alcohol-water mixture. Other steps of the process are the same as those used previously. (A.G.W.)

28463 SEPARATION OF GASES BY DIFFUSION. John Eric Jolley (to E. I. du Pont de Nemours and Co.). U. S. Patent 3,172,741. Mar. 9, 1965. Filed Dec. 15, 1958.

In a process for separating light gases such as hydrogen and helium from mixtures of other gases, the mixture is brought into contact with one side of a thin, substantially non-porous membrane formed from a plastic film-forming polymeric material. The membrane is a polymer having at least one type of polar group with a dipole moment of at least 2.5 Debye units, preferably polyacrylonitrile or polyethylene terephthalate. That portion of the gas that permeates through the membrane is removed from the opposite side to maintain a pressure differential across the membrane. Separation factors obtained depend on the material used, the film thickness, the pressure differential maintained, and the number of stages used. (A.G.W.)

28464 HYDROGEN DIFFUSION PROCESS. Leonard R. Rubin (to Engelhard Industries, Inc.). U. S. Patent 3,172,742. Mar. 9, 1965. Filed Mar. 7, 1963.

Hydrogen may be separated from a mixture of gases by diffusion through a nonporous septum formed of a Pd–U or Pd–U–Ag alloy. The alloys should contain 1 to 10 parts by weight of U and, in ternary alloys, 10 to 25 parts of Ag per 100 parts of alloy. At temperatures of 200 to 800°C the alloys have greater strength than pure Pd and equal permeability to hydrogen. (A.G.W.)

28465 IMMISCIBLE LIQUIDS SEPARATOR. James C. Hesson (to U. S. Atomic Energy Commission). U. S. Patent 3,181,700. May 4, 1965.

The immiscible liquids separator includes a vessel, a heavy liquid outlet line having an opening adjacent the bottom of the vessel, a light liquid outlet line having an opening into the vessel above the opening in the heavy liquid outlet line, the light liquid line rising to a maximum height higher than the heavy liquid outlet line, the light liquid outlet line containing a portion of enlarged diameter adjacent the highest point of the heavy liquid outlet line, and means for increasing the pressure in the vessel. (AEC)

28466 PLUTONIUM ADSORPTION AND DESORPTION. Andrew E. Reisenauer and Lloyd L. Ames, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 3,183,059. May 11, 1965.

A process is given for desorbing plutonium values from apatite with an eluant solution after a thin calcium carbonate layer has been formed on the surface of the plutonium-containing apatite by contact with an aqueous carbonate solution. (AEC)

ENGINEERING

General

Refer also to abstracts 29468 and 29618.

28467 (AAEC/TM-285) THERMOELASTIC STRESSES IN A HOMOGENEOUS SPHERICAL FUEL ELEMENT OF A PEBBLE-BED REACTOR. J. J. Thompson (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Mar. 1965. 11p. Dep.(mn).

Equations are developed for thermoelastic stresses in a sphere, which are applicable to problems involving non-uniform heat generation and spatially variable surface heat transfer coefficients. (auth)

28468 (CRE-1176) EFFECT OF SEAL RING DEFLECTION ON THE CHARACTERISTICS OF FACE-TYPE MECHANICAL SHAFT SEALS IN HIGH-PRESSURE WATER. R. D. Watson (Atomic Energy of Canada Ltd., Chalk River (Ontario)). Oct. 1963. Re-issued Apr. 1965. 22p. (AECL-2242) Dep.; $1.00(AECL).

The effect of seal ring deflection on the characteristics of face-type seals was investigated by assuming that the seal rings deflected in the following ways: (1) The deflection varied uniformly across the face. (2) The deflection at any point across the seal face was proportional to the pressure at that point. Theoretical curves were developed that show the variation in balance ratio and leak-rate with film thickness for different deflections of the seal ring. The effects of seal ring size and fluid viscosity on the seal characteristics were also considered. Symmetrical deflection of the rings of a face-type mechanical shaft seal is necessary to provide stability. To be useful the deflection must allow a wedge of water to form between the faces. Seals with absolutely flat and parallel faces are unstable. Wear and erosion are believed to be partly responsible for seal failure since they produce an out-of-balance condition which in turn leads to overheating and more wear. (auth)

28469 (GAMD-6027) PLEXIGLASS MODEL FOR THE TARGET CONCRETE PRESSURE VESSEL. R. J. Kiefer (General Atomic, San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science). Nov. 9, 1964. Contract AT(04-3)-167. 19p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Results are presented of a numerical and experimental stress-and-strain analysis for a thick-walled pressure vessel. The numerical analysis was made with the TARGET code, while the experimental analysis was carried out on a Plexiglas model of the 1000-Mw(e) PCRS geometry. Good agreement of the surface strain data was obtained on the outside surfaces, but the experimental values were low on the inside surfaces. (D.L.C.)

28470 (INR-582/XIV,XI) PERENOSNOI IONOOBMENNO-MEKHANICHESKII FIL'TR DLYA OCHISTKI VODY V REAKTORNYKH USTANOVKAKH. (Mobile Unit for Demineralization and Purification of Reactor Water). Z. Begushevski and S. Tsemnevski (Institute of Nuclear Research, Warsaw (Poland)). Nov. 1964. 28p. Dep.

Design and hydraulic parameters of the mobile unit for demineralization and purification of water in reactor primary system were given, including the results of measurements on the ion-exchange filter. Filter construction was based on the interdependence of the chemical characteristics of reactor water upon the operational requirements for reactors at Swierk Nuclear Research Center. (auth)

28471 (TID-21855) INVESTIGATION OF COALESCENCE OF SOLID-LIQUID SYSTEMS. Report No. 0780-01-(02)FP. Period Covered: May 1, 1964–April 30, 1965. R. L. MacLean and T. A. Gaukler (Aerojet-General Corp., Downey, Calif. Research and Engineering Div.). Apr. 28, 1965. Contract AT(04-3)-474. 49p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

Controlling mechanisms for coalescence of water with solids were studied by means of high-speed photographic measurements. The time between apparent contact to the first appearance of coalescing neck or lens was used as an indication of mechanism rates for initiation coalescence. This time period must be relatively short to ensure that solid particles and droplets will coalesce after impact before rebounding and separating. Measurements were made for water and different solids such as glass, alumina, agate, and carbon. The electric properties of a solid appeared to influence the coalescence by allowing an increase in voltage between the solid and droplet to increase the rate of coalescence. Nonconducting solids appeared to show no significant effect between applied voltage and coalescence delay time. From the experimental data, it is concluded that the chemical nature of a solid in coalescence with water has some effect on the coalescence rate. The effect of surfactant coatings on the solids was measured and found nonconclusive as to mechanism influence. Measurements conducted on two different types of carbon suggested that either a surface topography or a minor compositional factor causes a marked change in coalescence delay time. (auth)

28472 ELECTRICAL POWER REQUIREMENTS FOR FUTURE SPACE EXPLORATION. L. H. Wood, R. I. Vachon, and R. N. Seitz (Marshall Space Flight Center, Huntsville, Ala.). IEEE (Inst. Elec. Electron. Engr.), Trans. Nucl. Sci., NS-12: 189-96(Feb. 1965).

The electric power requirements for various possible space missions, are discussed. Probable time frames are included wherever possible. Three categories of missions are considered: earth-orbital operations including communication and weather staellites, manned orbiting laboratories, and scientific satellites; lunar operations in the post-Apollo era; and intrasolar system operations including manned and unmanned planetary missions, solar probes, and out of the ecliptic probes. Power levels necessary to support the missions vary widely; various levels from a fraction of a kilowatt to hundreds of kilowatts are discussed. (auth)

28473 SHALLOW ANISOTROPIC PLASTIC SHELLS. M. Sh. Mikeladze (Georgian Polytechnic Inst., Tbilisi, USSR). Nucl. Struct. Eng., 1: 414-18(Apr. 1965).

Equations describing the behavior of shallow anisotropic plastic shells were derived. The treatment includes the problem of load carrying capacity and optimum (minimum volume) design. The material of the shell is assumed to be rigid-plastic and to obey Hill's yield condition and the associated flow rule. (auth)

Applications of Nuclear Explosions

28474 (PNE-600F) TECHNICAL DIRECTOR'S SUMMARY REPORT. M. D. Nordyke, R. W. Terhune, R. F. Rohrer, L. J. Cauthen (Lawrence Radiation Lab., Univ. of California, Livermore), and J. L. Spruill (Army Nuclear Cratering Group, Livermore, Calif.). Dec. 1964. Project DUGOUT. Contract [W-7405-eng-48]. 111p. Dep.; $4.00 CFSTI.

Project Dugout was a chemical explosive row charge cratering experiment in hard rock conducted as part of the Plowshare Program. The Dugout design consisted of five nominal 20-ton spherical charges of nitromethane emplaced at a depth of 18 m in basalt with a spacing between charges of 13.7 m. All five charges were detonated simultaneously at about 0806 PDT on 24 June 1964. The crater produced had an average apparent crater width over the center 60% of the crater of 41.5 m. The average apparent

crater depth was 10.7 m and the length from one end to the other was 87.5 m. The lip height along the sides of the crater averaged about 7.3 m, whereas off the ends its height was about 4 m. The total apparent crater volume was about 16,080 m^3. The crater volume in the center 60% corresponded to 3640 m^3 per 20-ton charge. The resulting crater was 36.5% wider and 41% deeper than predicted. This is believed to be due to the use of too small a spacing resulting from reliance too heavily on earlier cratering results in basalt using TNT charges. Comparison of Dugout results with nitromethane cratering data only indicates that the Dugout width was only 13% too large and the depth was 6% less. Based on these considerations it is concluded that the row charge concepts developed earlier in alluvium may be extended, at least approximately, to hard rock media. Comparison of early surface-motion targets, and from accelerometers in the ground zero area, indicates very good agreement with a peak surface velocity of about 48 m/sec Data from strong motion measurements at ranges of 170 to 1580 m on lines south and west of the east-west array indicates anisotropic propagation only at the two closest stations. Beyond 200 km, the motions were isotropic and consistent with a single 100 ton source. Air blast signals measured close to the detonation indicated anisotropic propagation with signals in a direction perpendicular to the array being about a factor of 1.5 to 2.0 above those in a direction parallel to the array. The close-in air blast measurements from Dugout compared favorably with results from single cratering detonations in basalt if it is assumed that (1) signals propagated in a direction parallel to the array result from superposition of the air blast waves at the source, and (2) signals in the perpendicular direction result from superposition at the gage. The long range air blast signals demonstrated somewhat similar anisotropy whereby the signals in the parallel direction were about a factor of 2 greater than the signals in the perpendicular direction. Assumption of source superposition leads to an average transmissivity factor for long range air blast of 0.11, in excellent agreement with previous experience. The maximum cross wind base surge radius was about 320 m. The maximum base surge height was about 350 m and the maximum main cloud height was about 1220 m. (auth)

28475 (PNE-610F) CONCRETE, GROUT, AND SHOTCRETE SUPPORT, AND DESIGN AND POSTSHOT EVALUATION OF STEM. Final Report. Kenneth L. Saucier (Army Engineer Waterways Experiment Station, Vicksburg, Miss.). Dec. 1964. Project DUGOUT. 46p. Dep.; $0.50(cy), 1(mn) CFSTI.

Project DUGOUT consisted of the simultaneous detonation of five, 20-ton, chemical, row-charge explosives in hard, dry rock at a scaled depth of burst of 185 $ft/kt^{1/3.4}$. A description is given of the following work performed for the project: (1) the design and placement of grout mixtures used in grouting satellite holes surrounding the anticipated trench, (2) the design and supervision of the placement of a shotcrete mixture used in lining the walls of each of the shot cavities, (3) the design and supervision of the placement of a concrete mixture used in stemming the access holes to each of the shot cavities, (4) the design of the stem configuration for each of the five shot holes, and (5) postshot evaluation of stem design and survey of stem ejecta. The stems designed for the project appear to have acted effectively. Apparently the lower part of the stems, from the reinforced concrete keys down, failed in compression and shear with the steel taking predominant shear stresses. Tensile spalling and bond failure were evident in the upper stem portions; however, there was evidence of conjugate concrete-basalt action in this area. (auth)

28476 (TID-3522(7th Rev., Suppl.1)) PEACEFUL USES FOR NUCLEAR EXPLOSIVES. A Selected Annotated Bibliography. Hugh E. Voress, comp. (Division of Technical Information Extension (AEC), Oak Ridge, Tenn.), and Carl R. Gerber (Division of Peaceful Nuclear Explosives (AEC), Washington, D. C.). Apr. 1965. 36p. Dep.; $2.00(cy), 1(mn) (CFSTI).

References (109) are given to reports and journals on excavation, natural resources development, and scientific applications published from 1961 through July 1964. Author and report number indexes are included. (P.C.H.)

28477 ISTHMIAN CANAL—THE POTENTIAL HAZARDS OF NUCLEAR EXCAVATION. John Hurd. Nucl. News, 8: No. 5, 14-17(May 1965).

Nuclear excavation of a sea-level Isthmian canal would be accompanied by three potential hazards: radioactivity, air blast, and ground shock. The nature of the hazard, safety standards selected, and measures taken to meet the standards are outlined. (H.G.D.)

Facilities and Equipment

28478 (AECL-2227) WORKSHOP CELL OPERATIONS AT CHALK RIVER NUCLEAR LABORATORIES. M. H. Thomas (Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.). Mar. 1965. 13p. Dep.; $0.50(AECL)

The CRNL experimental program has required a flexible workshop cell. Flexibility to change from one operation to another with the minimum of difficulty is important when facilities are limited. Successful handling procedures are described for moving highly active fuel and samples between cell and reactor or storage positions. The principles and operational procedures for the maintenance of loop fuel, the examination of fuel units, and the dismantling and sectioning of various fuels are illustrated. Special procedures, for research and development experiments on irradiated reactor materials, are mentioned. (auth)

28479 (CEA-R-2754) LE CENTRE ATOMIQUE IDEAL. (The Ideal Atomic Center). Roland Mas (Commissariat à l'Énergie Atomique, Saclay (France). Centre d'Etudes Nucleaires). Mar. 1965. 77p. Dep.(mn).

Considerations are presented which should prove to be of interest to all those who have to design, to construct, and to operate a nuclear research center. A large number of the ideas presented can also be applied to non-nuclear scientific research centers. A review is given of the various problems with which the constructor is faced: ground plan, infrastructure, buildings, and the large units of scientific equipment in the center, and those problems facing the director: maintenance, production, supplies, security. The relationship which ought to exist between the research workers and the management is stressed. With this aim in view, the creation of a National School for Administration in Research is proposed which would train administrative executives for public or private organizations; they would be specialized in the fields of fundamental or applied research. (auth)

28480 (CEA-tr-R-1818) GOULOTTE ELECTROMAGNETIQUE POUR LE TRANSPORT DU METAL LIQUIDE. (Electromagnetic Channel for Liquid Metal Transport). L. A. Verte. Translated into French from Elektrichestvo, [No.] 5, 74-7(1962). 13p. Dep.(mn); $1.60 (fs), $0.80(mf) JCL.

The electromagnetic channel, a new type of induction pump for the transport of liquid metals, is described. Its difference is that the metal sustains the action of a magnetic field gliding, not in a closed channel, but in an open one. The vertical, longitudinal, and normal components of the induction of the magnetic field were determined theoretically and experimentally. The results are shown graphically and discussed. (J.S.R.)

28481 (CEA-tr-R-1821) POMPE A INDUCTION EXPERIMENTALE POUR LA FONTE LIQUIDE. (Experimental Induction Pump for Liquid Melts). L. A. Verte. Translated into French from Elektrichestvo, [No.] 12, 64-5 (1963). 9p. Dep.(mn); $1.10(fs), $0.80(mf) JCL.

The design and performance of a triphase induction pump for liquid melts are described. The experimental installation for testing the pump is shown schematically. The short term laboratory test gave promising results. (J.S.R.)

28482 ENGINEERING DEVELOPMENT OF A PRACTICAL 1200°F SODIUM-VAPOR TRAP. Edward L. Kimont (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 147(May 1965).

28483 REMOTE WELDER BONNET (Engineering Materials). (Oak Ridge National Lab., Tenn.). 2 drawings. (CAPE-1174)

The equipment described is used with a welder for remote welding in a protective environment. The housing is fabricated of Sch. 40, seamless pipe 10 in. in dia. and 17½ in. long. The bottom is fabricated of ¼-in., 204 L stainless steel and the top of 1-in.-thick steel. Drawings (2) are encluded. (For Details, See TID-4100). (TCO)

28484 ON STOCKPILE ELECTRICAL RELIABILITY OF SEALED SWITCHING DEVICES FOR NUCLEAR WEAPONS. Paul Mahler (Picatinny Arsenal, Dover, N. J.). 8p. (CONF-630406-1)

From 11th National Conference on Electromagnetic Relays, Stillwater, Okla.

Criteria for electric reliability of sealed switching devices, whose primary function is either to make or break circuits on command, is discussed. Four cases illustrating the need for an absolute reliability criterion are described: the use of a mixture of molding power and metal soap for molding; the operation of a sealed switching device requiring the use of a spring whose failure could cause malfunctioning of a circuit; the use of circuit-making and -breaking rotors, made from heat-stabilizable, thermosetting plastic containing a re-enforcing fibrous material, and as glass or asbestos; reactive metals left unprotected against corrosion because of circuit requirements. Criteria are listed and discussed for insulation resistance and breakdown, circuit contamination, and hence stockpile electric reliability, and procedures to assure these criteria are given. (M.J.T.)

28485 DRILLING MACHINES. Emmanuel de Robien, Georges Fritz, Andre Lachambre, and Jean Claude Mettetal (to Commissariat a l'Energie Atomique). British Patent 985,761. Mar. 10, 1965. Priority date Feb. 5, 1962, France.

A machine is described for drilling at both ends fuel cartridges that have been used in reactors to remove all the fission gases. The machine includes a central cylinder formed with a central passage open at both ends and adapted to receive the cartridge, a top carriage and a bottom carriage disposed on either side of the cylinder and providing a seal-tight closure of the passage in the cylinder, and a drilling assembly. In the drilling assembly, a combined motor and reduction train unit are provided to rotate the drilling means at each end of the cylinder. Means are provided for controlling and guiding the movements of each carriage relatively to the cylinder. The gases and liquids contained in the cartridges and released when the cartridges are drilled are recovered by means connected by ducts to the top and bottom parts of the cartridge. (B.L.M.)

28486 FLUID-TIGHT COUPLING DEVICE. Georges Fritz, Jean Leconnetable, Jean Claude Mettetal, and Jean Winter (to Commissariat a l'Energie Atomique). British Patent 985,762. Mar. 10, 1965. Priority date Feb. 23, 1962, France.

A connecting device is provided for making a fluid-tight connection between two ducts and includes a first and second element that respectively define the two ducts and a valve member mounted in the first element. In addition to the valve member, the first element includes an intermediate resiliently deformable part made of polythene and a closure part carried by the deformable part and biassed into a cooperating seat around the first duct so as to seal the seat. The second element includes a valve operating part that is movable relative to the first element to lift the closure part from the seat so as to connect the two ducts. The means for joining the two elements is a coarse pitch screw thread. (B.L.M.)

28487 A MACHINE FOR EXTRACTING IRRADIATED NUCLEAR FUEL CARTRIDGES FROM STORAGE CASINGS. Rene Guilloteau (to Commissariat a l'Energie Atomique). British Patent 987,171. Mar. 24, 1965. Priority date Apr. 15, 1960, France.

A machine is provided for extracting irradiated fuel cartridges from their storage casings prior to processing. The machine includes two assemblies in combination. Each is provided with means for receiving and clamping the casing by one of its ends in a substantially horizontal position. Means are provided for exerting a longitudinal traction force on the casing that contains at least one cartridge. A cutting head is arranged between the assemblies for subdividing the casing into two parts, and means are included for swinging each of the resultant halves into a position with the open ends directed downwardly. (B.L.M.)

28488 IMPROVEMENTS IN OR RELATING TO MASTER-SLAVE MANIPULATORS. Hans Walischmiller. British Patent 987,299. Mar. 24, 1965. Priority date Apr. 30, 1962, Germany.

A master-slave manipulator is described that is made up of a master arm, a slave arm, and an intermediate tube extending through the protective wall. The intermediate tube includes three tubes concentrically arranged one inside the other. The inner tube is rotatably mounted within the middle tube and contains the motion transmission means extending between the master arm and the slave arm. The end of the inner tube adjacent to the master arm is provided with two detachable end plates, the second somewhat remote from the first. The guided rotatable shafts comprising the motion transmission means contained in a tubular housing are mounted in the first end plate. The shafts are rotatably mounted in bearings provided in the second end plate mounted on the end of the tubular housing. Sealing means including at least two resilient O-rings and an intermediate ring are provided exclusively at the end of the intermediate tube adjacent to the master arm to provide a seal between the slave and master arms. The rings are pressed by a thrust ring axially against a shoulder of the middle tube. Two radially clamping resilient lipped sealing rings are arranged on the middle tube to seal it off against the inner tube. (B.L.M.)

28489 REMOTE-CONTROLLED MANIPULATING APPARATUS FOR MANIPULATING OBJECTS INSIDE SEALED CHAMBERS. Guy Cherel and Henri Forey (to Commissariat à l'Énergie Atomique). Canadian Patent 685,238. Apr. 28, 1964. Priority date Jan. 20, 1959, France.

A telemanipulator is described that is controlled by units outside the chamber but not mechanically connected to the internal control units, merely magnetically connected to these internal units. Since the manipulator is not directly connected to the control unit outside the chamber, a manipulation chamber can be perfectly sealed with respect to the ambient medium. All the external control units may be transferred from one chamber to another. All the magnetic control units outside the chamber are mounted in a box, half of which is movable on the outside surface of the roof of the non-magnetic sealed chamber and half of which is movable against the inside surface of the roof. All of the controlled magnetic operating units that are mounted inside the chamber are capable of following all the displacements of the controlling external box half. Rotary motion is controlled in the same manner by the rotation of the external box half. (B.L.M.)

Heat Transfer and Fluid Flow

See also PHYSICS — General.

Refer also to abstracts 28284, 29388, and 29472.

28490 (ACNP-65002) PRIMARY SEPARATION OF STEAM FROM WATER BY NATURAL SEPARATION. PART I. (Allis-Chalmers Mfg. Co., Milwaukee, Wis. Atomic Energy Div.). Apr. 15, 1965. Work Performed Under United States–Euratom Joint Research and De-

velopment Program. Contract AT(11-1)-1186. 78p. (EURAEC-1389). Dep.(mn); $3.00(cy), 2(mn) CFSTI.

Tests were performed in a high-pressure steam–water loop to determine the permissible steam release rates from a two-phase interface for various pressures and distances above the interface. An equation for predicting these rates was also developed. Air–water and steam–water tests were performed to study the void fractions in the downcomer region. These tests involved several geometry changes to determine their effect on the downcomer void fraction. An equation for predicting the downcomer void fraction in both air–water and steam–water mixtures was developed. High-pressure steam–water tests were performed to determine the void fractions in a bubbling two-phase mixture. As a conclusion to this test, an equation was developed to predict the void fractions in both flowing and non-flowing two-phase mixtures. A level detector for accurately locating the interface of a two-phase mixture was also developed. (auth)

28491 (AD-607555) AN EXAMPLE OF ONE-DIMENSIONAL GAS FLOW WITH FRICTION AND HEAT ADDITION. M. L. Rosenzweig (Space Technology Labs., Inc., Los Angeles, Calif.). May 8, 1959. Revised Sept. 10, 1959. 21p. (STL-TR-59-0000-00674). $1.00(CFSTI).

A simplified method is presented for the estimation of heat transfer and pressure loss in problems involving the flow of a compressible fluid through a constant area pipe in the presence of friction and heat addition. No analysis is given; only significant formulas are presented. An example concerning the heat transfer and pressure drop through a nuclear rocket reactor is used to illustrate the practical design application of the formulas. The calculation leads to design curves indicating the effects of varying inlet Mach number on pressure loss, exit Mach number and total area required to pass a given mass flow. (auth)

28492 (AECL-2253) THE FEASIBILITY OF MEASURING FLOW BY INDUCING PRESSURE RESONANCE IN A PIPE STUB TEED OFF A FLOW HEADER. L. M. Watkins (Atomic Energy of Canada Ltd., Chalk River (Ontario)). Apr. 1965. 51p. Dep.; $1.50(AECL).

The results indicated that it is possible to obtain some measure of flow with this technique, but the accuracy is not likely to be good, nor is there likely to be much of a cost advantage over conventional flow measurements. If short pipe stubs are used, high header flow velocities, with attendant high pressure drop, are required to induce resonance. Resonance can be induced at lower header velocities by using longer pipe stubs but the greater length limits piping arrangements. The theory of closed-end organ pipes which relates to this investigation is given in an appendix. (auth)

28493 (ARL-65-18) RECENT RESULTS IN THEORETICAL AND EXPERIMENTAL HYPERSONICS AND THEORETICAL MAGNETOHYDRODYNAMICS. (Cincinnati Univ., Ohio). Aug. 1964. Contract AF33(616)-8453. 59p. CFSTI

Theoretical and experimental results in continuum hypersonic flow and theoretical results in magnetohydrodynamics are reviewed and summarized. The theoretical investigation includes three dimensional hypersonic flow problems, shock interaction studies, weak interacting hypersonic flow over cones, hypersonic leading edge problems, wake problems, and an analysis of binary boundary layer problems. Additionally, a method is reviewed whereby the equations of a steady, two-dimensional compressible, isentropic flow of a perfectly conducting gas with an aligned magnetic field can be reduced to those of the conventional non-magnetic case. The experimental portion of the investigation was conducted in a Mach 14, twenty-inch hypersonic wind tunnel. Topics investigated include the hypersonic wake problem, shock interaction, hypersonic flow over cones at low and high angles of attack, hypersonic inlet problems, hypersonic flow over flat plates with and without a glow discharge, and flow over delta wings at high angles of attack. Brief descriptions of the calibration of the above mentioned tunnel and evaluation of instrumentation used in conjunction with the tunnel are also included. (auth)

28494 (DPST-65-83-1) USAEC-AECL COOPERATIVE PROGRAM MONTHLY PROGRESS REPORT, JANUARY 1965. H. S. Hilborn, comp. (Du Pont de Nemours (E. I.) & Co., Aiken, S. C. Savannah River Lab.). Feb. 26, 1965. Contract AT(07-2)-1. 9p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Burnout tests on fuel-rod bundles in boiling water channels are reported. (T.F.H.)

28495 (EUR-2183.e) EVALUATION OF THE HEAT TRANSFER AREA AND THE STEAM TEMPERATURE AS A FUNCTION OF POWER, FOR A VERTICAL STEAM GENERATOR, BY MEANS OF A DIGITAL COMPUTER. G. Van Hulst and G. L. Pieterse (Reactor Centrum Nederland, The Hague (Netherlands)). 1965. 65p. Dep.(mn).

Calculations were made of the heat transfer area for the NERO and SENN steam generators based upon the local conditions. The relation between steam temperature and power is evaluated. An Algol digital computer code was used for the iterative calculation of the steam temperature, and the principle of the calculation method is presented in block diagram. (L.B.S.)

28496 (EUR-2229.e) THE USE OF A NEW HEAT REMOVAL SYSTEM IN SPACE THERMIONIC POWER SUPPLIES. J. Bohdansky, C. A. Busse, and G. M. Grover (European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center). 1965. 10p. Dep.(mn).

Structures of very high thermal conductance known as heat pipes are described. For a specific method of fabrication and for operation in gravity free conditions, a relation is derived for computing the optimum heat transfer as a function of the pipe radius, length, and the physical properties of the fluid. For a pipe of one centimeter radius and fifty centimeters long, the theory predicts heat fluxes of from 3 to 95 kilowatts. Possible uses of heat pipes in space power supplies are discussed. These uses depend strongly on the lifetime and operating temperature limits. (auth)

28497 (EURAEC-1114) SWIRL FLOWS IN BOILING WATER. Final Report No. 1. C. Moussez, A. Rosuel, G G. Sourioux, and D. Eidelman (Societe National d'Etude et de Construction de Moteurs d'Aviation, Suresnes (France). Division Atomique). Sept. 29, 1964. Work Performed under United States–Euratom Joint Research and Development Program. Contract 058-61-7 RDF. 111p. Dep.(mn); $4.00(cy), 3(mn) CFSTI.

The heat transfer, flow, burnout, and neutronic characteristics of two-phase steam-water vortex flows in realistic-geometry fuel channels are studied. The vortex flows are produced by twisted tapes placed at intervals in the reactor core. (T.F.H.)

28498 (GEAP-4637) HEAT TRANSFER IN PARALLEL ROD ARRAYS (thesis). W. A. Sutherland (General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.) and W. M. Kays (Stanford Univ., Calif. Dept. of Mechanical Engineering). Apr. 1965. Contract AT(04-3)-189. 131p. Dep.(mn); $4.00(cy), 3(mn) CFSTI.

Submitted by W. A. Sutherland to Stanford Univ., Calif. Dept. of Mechanical Engineering.

The general problem of heat transfer in parallel rod arrays is considered. To accommodate the complexity introduced by this configuration, a method of analysis is developed using the technique of superposition of fundamental solutions. Fundamental solutions are determined experimentally which may be used to predict heat transfer accurately in parallel rod arrays of various spacings and with arbitrary power distribution from rod to rod. Predictions made for uniform and nonuniform power distributions are compared with measurements made of these conditions. The experimental investigation was conducted with air flow (Pr = 0.70) past electrically heated rods. The rod center-to-center spacing to rod diameter ratios of 1.15 and 1.25 were investigated for fully developed turbulent flow. Experimentally determined fundamental solutions are presented for Reynolds numbers of 7000 to 200,000. These results provide the engineering information

necessary for design optimization of heat transfer in parallel rod arrays, and is the first step leading to a subsequent objective of developing higher performance configurations. (auth)

28499 (GEAP-4844) A PROGRAM OF TWO-PHASE FLOW INVESTIGATION. Quarterly Report No. 8, January–March 1965. G. Bijwaard, F. W. Staub, and N. Zuber (General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.). Apr. 10, 1965. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(04-3)-189. 73p. (EURAEC-1386) Dep.(mn); $3.00(cy), 2(mn) CFSTI.

Experimental and analytical studies are being conducted on thermal-hydraulic oscillations in forced-convection two-phase flow systems. The experimental research uses Refrigerant-22 as the working fluid. Oscillatory heat input tests have been completed at a reduced pressure of 0.12 and additional tests were carried out at a reduced pressure of 0.22 with very low inlet subcooling. The latter was required by the need for first comparing the results of the analysis of the void propagation equation with the data for low inlet subcooling. The complete test results of the dynamic void fraction measurements taken to-date are summarized in addition to sampled data on the dynamic pressure drop. The void propagation equation was applied to the range of data taken in this investigation, and the computer solutions of the developed equations are compared with the data taken at oscillatory heat input and low inlet subcooling. Good agreement is shown between predicted and measured values of: 1) the average void fraction, 2) the amplitude of its periodic variation and 3) the phase angle, i.e., velocity of propagation, of the void oscillation. The loss of accuracy in predicting these values, which is introduced by not considering the effect of flow regime, was also demonstrated. A computer solution and an approximate but simple, closed form analytical solution of the void propagation equation are presented for the case when the oscillatory power input to the liquid is of the form $(1 + \epsilon \sin \omega t)$. The solutions predict both the rate of propagation and the wave form of the void disturbance (as it propagates along the heated duct) caused by power oscillations. An analytical solution of the void propagation equation was derived for the case when the inlet flow oscillates as $(1 + \epsilon_f \sin \Omega t)$. The solution predicts both the rate of propagation and the wave form of the void disturbance (as it propagates along the heated duct) caused by inlet flow oscillations. A high speed motion picture has been prepared which show the process of nucleation and the resulting vapor bubble behavior in the liquid film adjacent to the heated wall during the annular flow regime. (D.L.C.)

28500 (LA-DC-5309) LAMINAR INCOMPRESSIBLE FLOW IN CHANNELS WITH POROUS WALLS. B. K. Knight, Jr., and B. B. McInteer (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [nd]. Contract W-7405-eng-36. 40p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

Some solutions of the non-turbulent flow problem are developed. Among these is the family in which, for negative ϵ approaching zero, v changes continuously from the parabolic profile to the squared-off boundary-layer profile; and in which, for positive ϵ approaching zero, v changes from the parabolic shape to a cos ξ functional form. The family of solutions so described appear to present a physically consistent and plausible answer to the problem. (auth)

28501 (LA-DC-6945) THE GENERATION OF OSCILLATIONS HAVING ACOUSTIC PROPERTIES IN FORCED CONVECTIVE HEAT TRANSFER TO CRYOGENS. Rodney S. Thurston (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1965]. Contract W-7405-eng-36. 13p. (CONF-650611-1) Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From Symposium on Heat Flow Below 100°K and Its Technological Applications, Grenoble, France.

Heat transfer has been known to be capable of inducing acoustic phenomena for more than 100 years. In relatively recent heat transfer experiments, which developed large radial gradients of physical properties, oscillations at acoustic frequencies have been observed. These cases have included gaseous flow at very high heat fluxes, and heat transfer to fluids undergoing a change of phase or in the supercritical region. Investigations were made of pressure oscillations appearing in forced convective heat transfer to initially liquid nitrogen and hydrogen in long small diameter flow channels. Some of the observed oscillations had characteristics similar to open-open pipe resonance and Helmholtz resonance. An analogy is presented between this phenomenon and that occurring in the Rijke tube, which was discovered in the last century. (auth)

28502 (PWA-2530) ANALYTICAL STUDY OF LIQUID METAL CONDENSING INSIDE TUBES. H. R. Kunz (Pratt and Whitney Aircraft, East Hartford, Conn.). Jan. 1965. Contract NAS3-2335. 87p. (NASA-CR-54352)

An analysis is presented of annular, two-phase flow inside of circular tubes. This analysis enables as estimation of the liquid film thickness for one or two-component flow and the heat transfer coefficient for condensing flow of a pure fluid. Special consideration is given to condensing liquid metals. Results obtained using this analysis were found to be in good agreement with measured values of liquid film thickness in vertical upflow and downflow for air–water mixtures in annular adiabatic flow. Similarly, condensing heat transfer coefficients calculated for vertical downflow of steam were found to be in good agreement with measurements. Finally, results of sample calculations are presented for condensing potassium. These results indicate that if no liquid-vapor interfacial resistance to heat flow is considered, the local values of condensing coefficients for potassium in vertical downflow inside a tube are higher than those calculated using Nusselt's theory for laminar condensing on a vertical surface with no liquid-vapor interfacial shear. This interfacial resistance to heat flow could result in significant reductions in heat transfer coefficients for condensing potassium. In the analytical approach, all liquid is considered to be flowing in an annular film along the tube wall with no liquid entrainment in the vapor core. Shear stress and heat flux distributions are derived for the liquid film and are combined with empirical expressions for turbulent diffusion coefficients and wall shear stress to enable calculation of the liquid velocity and temperature profiles. The expressions for turbulent diffusion coefficients are obtained from data for fully developed single-phase pipe flow. The velocity and temperature profiles enable the liquid film thickness and condensing heat transfer coefficients to be determined. No adjustment of empirical constants obtained from single-phase data was necessary to obtain agreement between theory and two-phase data. (auth)

28503 (SROO-260-6) LOW HEAT-FLUX BOILING OUTSIDE VERTICAL AND HORIZONTAL TUBES. Final Technical Report. John A. Clark, Herman Merte, Jr., William C. Elrod, and Edward R. Lady (Michigan Univ., Ann Arbor. Heat Transfer Lab.). Mar. 1965. Contract AT(38-1)-260. 232p. Dep.(mn); $6.00(cy), 4(mn) CFSTI.

Also submitted by William C. Elrod as a thesis to Michigan Univ., Ann Arbor.

An investigation was made of the heat transfer from the outside surface of single $\frac{3}{4}$ in. diameter tube to high-purity saturated water in the pressure range from 535 to 1550 psia. Heat transfer characteristics were examined under natural convection conditions and at a velocity of 4.7 ft/sec with the tube oriented horizontally (in cross flow) and vertically (with flow parallel to the axis). The heat flux range of interest extends from the non-boiling region through incipient boiling to a low heat flux in the nucleate boiling region. Three commercial heat exchanger tube materials were considered to examine the effects of variation of material properties and surface condition on the boiling characteristic curve. It is shown that close control of water chemistry is required to assure attainment of reproducible boiling data in the pressure range of this investigation. The dissolved oxygen content and level of suspended solid material in the boiling fluid are important parameters which must be maintained as nearly zero as practicable. The water pH does not have a direct effect on the boiling heat transfer characteristics but is important,

especially in ferrous metal systems, in the control of oxidation. Non-boiling forced convection heat transfer from the outside surface of horizontal tubes to high-pressure saturated water is correlated by the generally accepted equation for flow normal to a cylinder. For flow parallel with a vertical tube the equation for heat transfer from a flat plate may be used. In this study of the vertical tube the heat transfer coefficient did not vary with axial position since fully developed turbulent flow conditions existed. Natural convection non-boiling data may be represented by an equation of the following type: $Nu = C(Gr\ Pr)^4$. The value of the constant C required in this equation for heat transfer to high-pressure saturated water is approximately four times that reported by other investigators for studies at atmospheric pressure. Equations given which represent the natural convection nucleate boiling data obtained are of the form: $q/A = f(P)\ (T_w - T_{sat})^n$. The coefficients, f(P), and exponents, n, of these equations are affected by the pressure, tube material, and tube orientation. It is concluded that the non-boiling heat transfer characteristics are independent of material properties and for forced convection conditions may be predicted by generally accepted correlation equations. Incipient boiling points and nucleate boiling heat transfer are affected by pressure, velocity, tube orientation, and tube material. The more corrosion-resistant materials support higher surface superheat without boiling than do those more susceptible to corrosion. In the nucleate boiling region the variation of $T_0 - T_{sat}$ for Monel, Inconel, and carbon steel is small at a given heat flux but the slope of the characteristic curve is so steep that a large variation in heat flux results at a given value of $T_0 - T_{sat}$. Hence, a single boiling characteristic curve cannot be used to represent the nucleate boiling region for various materials under the conditions of this investigation without introducing large error. (auth)

28504 (UCRL-12356) ON MOVING POINT SINGULARITIES. Maurice Neuman (Lawrence Radiation Lab., Univ. of California, Livermore). Mar. 4, 1965. Contract W-7405-eng-48. 9p. Dep.; $1.00(cy), 1(mn) CFSTI.

A heuristic scheme for handling the motion of point singularities is outlined and applied to isentropic fluid flow and heat conduction. (L.B.S.)

28505 (WAPD-T-1648) TRANSIENT ANALYSIS OF STEAM GENERATORS IN NUCLEAR POWER PLANTS USING DIGITAL COMPUTER TECHNIQUES (thesis). William Grant Clarke (Pittsburgh Univ., Pa.). 1965. Contract AT(11-1)-Gen-14. 168p. Dep.(mn); $5.00(cy), 3(mn) CFSTI.

A mathematical model is presented for the steady-state and transient analysis of natural circulation steam generators used in nuclear power plants. Equations describing the conservation of mass, energy, and momentum are written for a secondary side system to match a primary side heat balance and secondary power delivered to a turbine-generator load. Major aspects of the model include steady state and transient recirculation flow, single-phase and two-phase density and pressure drop calculations, and automatic control of the steam drum water level. Both steady-state conditions and the transient response of this steam generator model are obtained by means of a digital computer program, using finite differencing methods. Experimental verification of the model is shown by comparison with steam generator test data from the Shippingport Atomic Power Station. (auth)

28506 (LA-tr-65-11) THE TRANSITION BETWEEN LAMINAR AND TURBULENT FLOW OF GASES IN A SMOOTH ROUND TUBE. H. Mache. Translated for Los Alamos Scientific Lab., N. Mex., from Forsch. Gebiete Ingenieurw., 14: 77-81(May-June 1943). 11p. Dep.(mn); $1.60(fs), $0.80(mf) JCL.

It is important to clarify whether in the transition region the velocity profiles are continuously transformed from the laminar into the flatter turbulent form, or whether more or less rapid alterations between the two flow structures occur. For this, air with an additive of a small measure of propane is allowed to flow through a perpendicularly standing tube; this combustible mixture is ignited at the upper end of the tube. In the case of laminar flow the quiet conical burning surface of the Bunsen burner is formed, with turbulent flow a flickering flame with a torn up burning surface is formed. The question posed is thereby decided, that in the transition region alternately one and then the other flow form appears. In the middle of the transition region the alternations between the two flow forms occur several times each second and they cannot be simply counted. At the boundaries they can be counted optically or acoustically so that by extrapolation the length and breadth of the transition region is fixed. Thus the method appears to be sufficient to ascertain the boundary values and its dependence upon the tube dimensions and the inlet configuration (experimentally). (P.C.H.)

28507 (WAPD-Trans-19) HEAT TRANSFER IN THE INITIAL SECTIONS OF FLAT AND RECTANGULAR CHANNELS. I. N. Sadikov. Translated for Bettis Atomic Power Lab., West Mifflin, Pa., from Inzh.-Fiz. Zh. Akad. Nauk Belorussk. SSR, 7: No. 9, 44-51(1964). 11p. Dep.(mn); $1.00(cy), 1(mn) CFSTI; $1.10(fs), $0.80(mf) JCL.

Heat transfer in the initial sections of flat and rectangular channels supporting laminar flow is studied on the basis of the linearized energy equation. Results of calculations for the temperature field and Nu numbers in various sections of the channel along its length are presented. (auth)

28508 EXPERIMENTAL STUDY OF BURNOUT HEAT FLUX FOR BOILING WATER REACTORS. Atsuo Yamanouchi (Hitachi, Ltd., Tokyo). Hitachi Hyoron, Spec. Issue, 141-5(Nov. 1964). (In Japanese)

Experiments were carried out on the boiling burnout heat flux in double tubes, with the internal tube electrically heated. The double tubes used were of two types: the internal and outer tubes concentric with each other, and those eccentric with each other. The ranges of the experimental conditions were as follows: pressure, 45 to 70 kg/cm^2; mass flow rate, 2.8×10^6 to 8.4×10^6 kg/m^2h; exit steam quality, up to 28 wt %; heated length, 200 to 400 mm; equivalent diameter, 8 to 19 mm; and minimum gap between the heated and outer tubes, up to 1.5 mm. The burnout heat fluxes for a single rod were close to those of a rod bundle; but they were considerably smaller than those for circular and rectangular tubes. The following equation for the lower limit of the burnout heat flux was obtained: $\phi_{Bo} = 2.8 \times 10^6\ e^{-3.0x}$ $(kcal/m^2h)$, where x is the exit steam quality. The influence on the burnout heat flux of the mass flow rate, system pressure, eccentricity, and L/De, were small under the given experimental conditions. (No relationships between them were obtained.) (auth)

28509 THE BREAKDOWN OF THE LIQUID FILM IN ANNULAR TWO-PHASE FLOW. G. F. Hewitt and P. M. C. Lacey (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Intern. J. Heat Mass Transfer, 8: 781-91 (May 1965). (AERE-R-4303)

The breakdown of liquid films may be the cause of burnout in the higher quality regimes of two-phase steam–water flow. An investigation of the breakdown of the liquid film in air–water annular flow is reported, which shows that the films can exist in a metastable state and will not break down unless there is an external disturbance. If such a disturbance is provided in the form of a dry patch on the solid surface then the minimum water flow rate at which the patch will be re-wetted decreases as the velocity of the gas phase increases. (auth)

28510 BURNOUT AND NUCLEATION IN CLIMBING FILM FLOW. G. F. Hewitt, H. A. Kearsey, P. M. C. Lacey, and D. J. Pulling (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Intern. J. Heat Mass Transfer, 8: 793-814(May 1965). (AERE-R-4374)

Studies were made on the behavior of a water film on the heated central rod of an annular test section carrying flowing steam at atmospheric pressure, the water having been introduced through a porous wall. The outer glass wall of the annulus was heated to prevent condensation and

droplet deposition, and hence the inner rod surface was rendered clearly visible. The onset of nucleation within the film was demonstrated and the conditions for its initiation were determined and compared with theoretical predictions; in other experiments burnout, or dry-out, heat flux measurements were made and related to the measured residual film flow on the heated rod. Visual and photographic studies revealed a relatively stable condition of break-up of the climbing film, with rivulets around dried-out patches, before the burnout trip operated. The residual film flow rate at which dry patches appeared was very small indeed and the burnout phenomenon was clearly the result simply of total loss of water from the film by evaporation and entrainment; the local value of the heat flux at the site of the burnout was evidently of only secondary relevance. There was evidence that bubble nucleation in the film could contribute appreciably to the loss by entrainment at high heat fluxes. (auth)

28511 AN EFFECT OF A TRANSVERSE TEMPERATURE GRADIENT ON TURBULENT PIPE FLOW. W. Murgatroyd (Queen Mary Coll., London). Intern. J. Heat Mass Trans., 8: 857-8(May 1965).

The validity of the shear surface technique in determining the effect of a transverse temperature gradient on turbulent pipe flow was investigated. It was found that the position of zero shear occurs where $d/dy\ (U/T) = 0$ and not where $dU/dy = 0$ as is usually assumed. It was concluded that the resulting change in the position of zero shear might well not be significant compared with the experimental errors involved. (P.C.H.)

28512 CRITICAL THERMAL FLUXES IN FORCED WATER FLOW. G. V. Alekseev, O. V. Remizov, N. D. Sergeev, B. A. Zenkevich, O. L. Peskov, and V. I. Subbotin. Teploenergetika, No. 3, 47-51(Mar. 1965). (In Russian)

The results of an investigation on the crisis of the boiling of water in channels of different geometry are explained. The fundamental mechanism of the process, together with the effects of secondary factors, were analyzed. The difference in the fundamental mechanisms of the crisis was recorded by interior and exterior cooling of the pipe. (tr-auth)

28513 A BOILING-FLOW MEASURE AT ATMOSPHERIC PRESSURE. Louis M. Shotkin (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 8: 93(May 1965).

28514 STATISTICAL EVALUATION OF FUEL HEAT-FLUX LIMITS. D. A. Ward (E. I. du Pont de Nemours and Co., Aiken, S. C.). Trans. Am. Nucl. Soc., 8: 93-4(May 1965).

28515 NATURAL CONVECTION IN A RECTANGULAR CAVITY. Willy Smith and Frederick G. Hammitt (Univ. of Michigan, Ann Arbor). Trans. Am. Nucl. Soc., 8: 97(May 1965).

28516 LINEARIZED ANALYSIS OF ONE-DIMENSIONAL MAGNETOHYDRODYNAMIC FLOWS. Roy M. Gundersen. Springer Tracts in Natural Philosophy. Volume 1. New York, Springer-Verlag, Inc., 1964.

An analysis of weakly non-isentropic quasi-one-dimensional flows of an ideal, inviscid, perfectly conducting compressible fluid subjected to a transverse magnetic field is presented. The propagation of non-uniform shocks and the effects of a small heat addition to an initially uniform stream are considered, together with simple wave flows and the effects of an oblique magnetic field. (D.C.W.)

28517 IMPROVEMENTS IN OR RELATING TO HEAT TRANSFER SURFACES. Henry Lloyd (to United Kingdom Atomic Energy Authority). British Patent 984,156. Feb. 24, 1965. Filed Sept. 14, 1962.

The heat transfer surface made up to a wire mesh sleeve attached to a cylindrical surface is particularly applicable to tubular fuel element cans. The wire mesh sleeve is preformed as an extensible body suitable for drawing onto a cylindrical member. The sleeve may be secured to the member by a split collar crimped to the sleeve and brazed to the member. If the member is hollow, the sleeve may be drawn over the end of the member into a cup shaped cap closing the end of the member. (B.L.M.)

Materials Testing

Refer also to abstract 29643.

28518 (EURAEC-1342) NON-DESTRUCTIVE WELDING. Quarterly Report No. 13, July 1–September 30, 1964. (Roentgen Technische Dienst N. V., Rotterdam (Netherlands)). Mar. 30, 1965. Work Performed under United States–Euratom Joint Research and Development Program. Contract 045-61-5-RDH. 28p. (EUR-2318). Dep.(mn); $2.00(cy), 1(mn) CFSTI.

Results of an ultrasonic examination for defects in welds were compared with the results of a destructive examination. It was found that the ultrasonic examination could locate a defect to within 5 mm. Structural changes between the weld and the base metal did not appear to influence the measurements. The orientation of the defect had a greater influence on the height of the defect echo than the magnitude of the defect. When the defect approached a perpendicular orientation to the plate surface, it was necessary to use two scanners mounted in tandem to adequately detect it. Discontinuities occurring near the surface of the weld were not detected by ultrasonic examination, and it was difficult to discriminate between a number of defects located in close proximity. (W.L.G.)

28519 NONDESTRUCTIVE TESTING OF PIPES IN HOT BLOOMS BY GAMMASCOPIC INSPECTION. A. Kohn (Institut de Recherches de la Siderurgie, St. Germain-en-Laye, France). Nondestructive Testing, 21: 241-6(July-Aug. 1963).

Some theoretical aspects of the problem are discussed and an experimental unit tested for several months in the line of a rolling mill, with the results obtained, are described. It follows from theoretical considerations that for detecting the presence of cavities in blooms of a given thickness of steel passing through the beam of γ radiation at a speed imposed by the rate of production, there are only a few variables in the designing of the apparatus, the values of which may be selected so as to give greatest sensitivity of detection. These are listed as: distance between source and detector; source intensity; and time constant. To detect defects of several inches in length in pieces travelling at 3 to 5 ft/sec, a time constant of the order of 0.05 to 0.10 sec must be chosen. From these theoretical considerations, it was found that the gammascopic method could be used for the detection of pipes in 8-in.^{2} blooms. These assumptions were confirmed by tests carried out with a 1-C ^{60}Co source on cold top sections of blooms, passing at speeds of 12 to 45 ft/min. The correlations between the peaks of the recorded curves and the pipes observed on slices taken from the investigated blooms were satisfactory, so an industrial unit was designed to carry out inspection of hot blooms in the rolling line. From the results, it was verified that every increase in the counting rate indicated by the diagram of the gammascopic recorder corresponded to a defect present in the bloom. Experiments on 8-in.^{2} section blooms passing through the γ beam at a speed of about 3 ft/sec showed that it is possible to detect a hollow cavity having an effective section of about 0.15 in.^{2} and a slag-filled pipe of about 0.25 in.^{2} effective cross-section. Safety features of the unit are described. (TCO)

28520 TUNGSTEN RESISTANCE FURNACES DESIGNED FOR OPERATION TO 3000°C. Norman P. Fairbanks (General Electric Co., Cincinnati). Trans. Am. Nucl. Soc., 8: 51-2(May 1965).

28521 GAMMAGRAFIE, EEN METHODE VOOR NIETDESTRUCTIEF ONDERZOEK. (Gammagraphy, A Method for Non-Destructive Materials Testing). J. J. P. Cattel,

A. de Sterke, and J. Th. Eering. The Hague, Nederlands Atoomforum, [1965]. 137p.

The texts of three addresses presented at a meeting of the Netherlands Atoomforum together with the Studiekern Niet-destructief Materiaalonderzoek of the Bond voor Materialenkennis on December 11, 1964, at Rotterdam were compiled. The topics were the significance of radiation research in technology, possibilities and limitations of gammagraphy with radioisotopes, and radiation safety in industrial radiography. (J.S.R.)

28522 PULSED EDDY CURRENT BOND AND LEVEL DETECTOR (Engineering Materials). (Argonne National Lab., Ill.). 2 drawings. (CAPE-1219)

The level detector is used in nondestructive testing to determine the sodium levels in the Experimental Breeder Reactor (EBR-2) fuel rods. The detector locates void areas in the sodium that is used as the heat transfer medium between the tube wall and the uranium pin. It also detects unbonded areas between the fuel and the clad. The detector consists of a pulse generating circuit, which supplies pulsed current to the driving coil, and a detecting circuit that receives and rectifies the differential voltage from the pickup coils. The rectified voltage is sent to a recorder. When the sodium voids are flat or have only slight variations, a cylindrical coil system is used but if the sodium levels vary around the periphery, a four channel point-probe-type pulsed eddy current system is used to determine the levels at 4 points on the periphery. The average value of these four measurements correlate with those determined by destructive tests to within ±0.030 in. Drawings (2) are included. (TCO)

28523 DEVICE FOR TESTING METAL SHEETS BY MEASURING THE TIME REQUIRED FOR ELECTROMAGNETIC PULSES TO PASS THERETHROUGH. Claus J. Renken, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 3,189,817. June 15, 1965.

A device for the nondestructive testing of conductive metal sheet is described. The device comprises a first coil mounted on one side of the metal sheet and spaced therefrom and a second coil mounted on the other side of the sheet and spaced therefrom. Means are provided for applying a pulsed signal to one of the coils and for detecting the time delay of the signal received by the other coil due to the presence of the metal sheet. (AEC)

Protective Structures

28524 (UCRL-7794) DYNAMIC STRUCTURAL ANALYSIS WITH SHORT TIME HISTORY. George L. Henderson (Lawrence Radiation Lab., Univ. of California, Livermore) Apr. 20, 1964. Contract W-7405-eng-48. 49p. Dep.(mn); $2.00(cy), 2(mn) CFSTI.

Equations were developed for use in the design of structures sustaining all types of superimposed dynamic loads with short time histories. Explosion-type blast waves in an air medium are used to illustrate the procedure for solution of the equations. Particular solutions for blast waves are formulated graphically with the aid of digital computers. (auth)

Space Propulsion

See also REACTOR TECHNOLOGY — Propulsion and Space.

Refer also to abstracts 29737, 29754, and 29755.

28525 (AFAPL-TR-64-126) DESIGN OF A MODULAR SOURCE CONTACT ION ENGINE. S. G. Forbes and J. C. Beynon (TRW Space Technology Labs., Thompson Ramo Wooldridge Inc., Redondo Beach, Calif.). Nov. 1964. Contract AF33(657)-10788. 111p. (AD-608619). $4.00 (CFSTI).

The design, fabrication and test of a two module engine capable of 20 mlb. of thrust with a grid replacement mechanism are described. Analyses which calculate the grid erosion rate due to charge exchange ionization, and rocket efficiency penalties associated with high engine weight and off-optimum I_s design are also included. Representative operational characteristics were: at 4600 sec. I_s, 62% electrical efficiency and 163 Kw/lb.; at 6950 sec. I_s, 80% electrical efficiency and 190 Kw/lb. Propellant utilization was 0.94s or greater. The grid replacement weight is equivalent to a propellant utilization of not less than 90%. Engine weight is one Kg/ampere of ion beam. Emitter material currently developed should permit operation with this same engine at 80% electrical efficiency at 5000 sec. The feasibility of replacing the accelerating grid structure in a high perveance contact ion thrustor has been demonstrated. This development removes electrode durability as a limiting factor in engine design and allows optimizing the overall rocket efficiency to a significant margin over the nonreplacement electrode engine. (auth)

28526 (P-2881-1(RAND)) A STUDY OF ELECTRICAL PROPULSION IN THE SPACE PROGRAM. Benjamin Pinkel and Donald L. Trapp (RAND Corp., Santa Monica, Calif.). Sept. 1964. 59p. (AD-607265). $3.00(CFSTI).

Electric propulsion systems in space flight are compared with other systems, particularly for the parameters of specific mass and operational endurance. Reliability, developmental time, and costs of electric propulsion are discussed. (auth)

28527 NUCLEAR PULSE PROPULSION. J. C. Nance (General Atomic Div., General Dynamics Corp., San Diego, Calif.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 177-82(Feb. 1965).

A general technical description and programmatic review of nuclear pulse propulsion activities over the last decade is presented. Major problem areas are reviewed, together with the status of current research efforts. Sufficient technical information is now available to predict achievable propulsion systems performance with a rather high degree of confidence based on current materials and nuclear technology. Expected performance is summarized for one specific small propulsion module capable of being orbited by a Saturn V. Finally, technical routes to achieve substantial performance improvements beyond those currently indicated are discussed. (auth)

28528 STATUS REPORT RADIOISOTOPIC PROPULSION SYSTEMS. J. C. Whiton (Marshall Space Flight Center, Huntsville, Ala.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 183-8(Feb. 1965).

Preliminary analysis of radioisotopic propulsion systems indicates considerable potential for application to scientific probes provided current engineering postulations can be realized. Typical applications, as indicated by analysis to date, would be high energy space missions such as solar probes to distances of approximately 0.05 A. U. and explorer probes in deep space out to the vicinity of Saturn. In order for the full calculated potential of these systems to be realized, the engineering feasibility of problems such as lightweight tankage, superinsulation for liquid hydrogen storage for more than thirty days in space, and tank-pressure propellant feed systems will have to be demonstrated. (auth)

28529 THRUSTORS FOR LOW ACCELERATION NUCLEAR ELECTRIC ROCKETS. John M. Teem (Electro-Optical Systems, Inc., Pasadena, Calif.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 197-220(Feb. 1965).

The principles, configurations, and performance status of electrostatic (ion-propulsion), electrothermal, and electromagnetic (plasma) propulsion systems are reviewed; and the important early missions for these systems are summarized, together with some new concepts for electrical propulsion systems. (D.C.W.)

28530 MISSION APPLICATIONS OF ELECTRIC PROPULSION. T. N. Edelbaum (United Aircraft Corp.,

East Hartford, Conn.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 221-8(Feb. 1965).

The prospects for electric space propulsion are examined by considering the applicability of both electric propulsion and competitive propulsion systems to various manned and unmanned missions. The mission performance of the various systems is compared; and some consideration is given to development schedules, development costs, operational costs, growth potential and auxiliary applications. It is shown that a single type of spacecraft, using electric propulsion systems currently under development, can be used for unmanned exploration of virtually the entire solar system. The competitive propulsion systems are incapable of performing many of these high-energy unmanned exploration missions. It is further shown that electric propulsion and nuclear rocket propulsion are competitive for manned Mars landing missions and lunar freighter missions. A combination of nuclear rocket propulsion and electric propulsion appears to offer the best performance for manned Mars missions. (auth)

28531 HIGHLIGHTS IN UNCONVENTIONAL NUCLEAR POWER AND PROPULSION SYSTEMS. V. Gradecak (Marshall Space Flight Center, Huntsville, Ala.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 229-39(Feb. 1965).

Several unconventional concepts of nuclear power and propulsion systems which have been proposed during recent years are surveyed. Besides the magnetohydrodynamics accelerators, also included are electrogasdynamic and fusion propulsion concepts whose indicated performance characteristics warrant a closer scrutiny because of their potential attractiveness for the future aerospace transportation systems. (auth)

28532 PLASMA PROPULSION DEVICE HAVING SPECIAL MAGNETIC FIELD. William R. Baker, R. W. Layman, and K. Halbach (to U. S. Atomic Energy Commission). U. S. Patent 3,191,092. June 22, 1965.

A magnetohydrodynamic apparatus for generating and ejecting a high velocity directed plasma beam is described. Such apparatus can be utilized, for instance, as a propulsion system for space vehicles or as a stationary plasma injector for containment apparatus. The plasma is formed in a cylinder having one end open. An axial magnetic field is provided in the cylinder and a short burst of neutral gas is injected into the space between the cylinder and a charged coaxial electrode therein. The gas is ionized by a discharge provided between the cylinder and the electrode. The expanding force of the magnetic field produced by the discharge current causes the plasma to be rapidly ejected out the open end of the cylinder. (AEC)

Vacuum Engineering

Refer also to abstracts 28622 and 28961.

28533 RADIATION INDUCED OUTGASSING IN AN ALUMINUM SYSTEM. C. O. Muehlhause, M. Ganoczy, and C. Kupiec (National Bureau of Standards, Washington, D. C.). IEEE (Inst. Elec. Electron Engrs.), Trans. Nucl. Sci., NS-12: 478-82(Feb. 1965).

The magnitude of the radiation-induced outgassing rate of a well cleaned and baked 6061-6063 aluminum system was investigated. Measurements performed in both the NBS 32 KC ^{60}Co gamma irradiation facility and the NRL 1-Mw reactor facility disclosed that the phenomenon of radiation-induced outgassing was principally due to the gamma and its associated electron field rather than to the fast neutron field. The magnitude of the effect observed was $7 \pm 4\ 10^{-11}$ torr liters/sec cm^2 per watt/gm. (auth)

28534 DESORPTION SPECTROMETRY AT LOW TEMPERATURES. E. B. Bas (Eidgenossische Technische Hochschule, Zurich). Vakuum-Tech., 14: 65-9(Apr. 1965). (In German)

Observations during a desorption experiment at low temperature in an ultrahigh vacuum (UHV) system are reported. A glass cold trap of special design is used as a desorption system. The temperature of the cold surface of the trap is measured by a thermocouple, which is connected to the x input of an x-y recorder, whereas the y input records the total pressure in the system indicated by a Bayard–Alpert gage. The UHV system is evacuated by a three-stage oil diffusion pump made of glass and operated with silicone oil. Eight pronounced pressure peaks in the early stage of evacuation were recorded as the temperature of the trap rose at a rate of 1.7°C/min from the temperature of liquid nitrogen to room temperature. At a later stage of evacuation only peaks with desorption energies of 10.5 and 18 kcal/mole remained strongly pronounced. The desorption spectrogram was recorded at about 2×10^{-8} Torr background pressure. After bake-out at 400°C for about 14 hours all peaks disappeared except the one at 10.5 kcal/mole, which moved to 11.7 kcal/mole. The desorption spectrogram was recorded at about 2×10^{-9} Torr background pressure. This peak can be ascribed to water vapor. This water-vapor peak moved back to its original position as evacuation was continued, and a weak reappearance of the other peaks could be observed at the same time. (auth)

GEOLOGY AND MINERALOGY

General

Refer also to abstract 29133.

28535 CALCULATION OF EXPLOSION-PRODUCED CRATERS—HIGH-EXPLOSIVE SOURCES. J. B. Knox and R. W. Terhune (Univ. of California, Livermore). J. Geophys. Res., 70: 2377-93(May 15, 1965). (UCRL-7738 (Rev.I))

A simple two-dimensional model is developed of cratering physics for high-explosive sources in alluvium during the surface gas-acceleration phase of excavation. The required initial conditions for the model are knowledge of the earth's free-surface topography and motion at the time the surface-gas acceleration begins (t_C) and knowledge of the cavity pressure and volume. At t_C the overburden material—that material between the cavity and the earth's free surface—is assumed to be homogeneous, incompressible fluid. At this time the cavity is approximated as follows: the radius of the lower hemisphere is calculated by a one-dimensional hydrodynamic plastic-elastic model of the response of a geologic medium to an explosive source, and the cavity configuration above the shot horizon is calculated from mass conservation of the overburden material and the calculated free-surface topography at the time t_C. In the model, the upper cavity surface is subdivided into elemental surface areas, and mass zones are defined which subtend these elemental surface areas. Newton's second law of motion with a simple phenomenological frictional force (calibrated on the Scooter event) is applied to each mass element. The cavity gas is assumed to behave adiabatically. The physical laws, assumptions, and initial conditions cited above provide a basis for the numerical simulation of the cavity evolution, mound development, and formation of the lip through up-thrust during the surface gas-acceleration phase of excavation. With the development of a calibrated numerical simulation model of excavation processes during the surface gas-acceleration phase, it is appropriate to explore the use of the model for estimating the apparent crater radii and depth for 0.5-kt high-explosive sources at various emplacement depths. Assuming a reasonable angle of repose for alluvium (45°), the apparent crater radii for scaled depth of burst from about 10 to 65 $m/kt^{1/3.4}$. These estimated crater radii compare very favorably with the observed (scaled) crater radii for high explosives in alluvium. The apparent (scaled) crater depths, for certain types of craters, are also calculated. Perhaps the most significant contribution of the study is the development of a physical model for calculating the time history of the mound, the lip formation, and the cavity geometry during the surface gas-acceleration phase of cratering. (auth)

28536 ABUNDANCES OF Na, Sc, Cr, Mn, Fe, Co, AND Cu IN 218 INDIVIDUAL METEORITIC CHONDRULES VIA ACTIVATION ANALYSIS. PART I. R. A. Schmitt (General Atomic Div., General Dynamics Corp., San Diego, Calif.), R. H. Smith, and G. G. Goles. J. Geophys. Res., 70: 2419-44(May 15, 1965).

Instrumental neutron activation analysis (INAA) was used to determine abundances of seven elements—Na, Sc, Cr, Mn, Fe, Co, and Cu—in 218 individual chondrules and 6 olivine crystals separated from 11 chondritic meteorites. The meteorites were of Type II (3), Type III (4), and ordinary (4). For comparison, abundances of these seven elements were also determined by INAA in these and other whole chondrites. The abundances of the seven elements determined in chondrules from Type II carbonaceous chondrites agree approximately with solar abundance values, but it is believed that the data are not yet extensive enough to justify regarding these chondrules as condensations from the primordial solar nebular matter. Chemical fractionation at high temperatures may well have occurred during chondrule formation. If so, agreement of abundances in Type II chondrules and in the sun may be fortuitous. (auth)

28537 ANOMALOUS Ar^{40} CONTENTS OF IRON METEORITES. David E. Fisher (Cornell Univ., Ithaca, N. Y.). J. Geophys. Res., 70: 2445-52(May 15, 1965).

The ^{40}Ar, ^{36}Ar, and ^{41}K contents of several iron meteorites were measured by neutron activation analysis. The data are in agreement with previous results which were interpreted as measuring a $^{40}K-^{40}Ar$ age. The possible effects of cosmic rays, primordial rare gases, and atmospheric gas diffusion were also investigated. These results are not in disagreement with an "age" interpretation; however, the nonconstancy of the $^{40}K/^{40}Ar$ ratio within the Santa Rosa meteorite argues against this interpretation. The origin of the ^{40}Ar in iron meteorites is not presently resolved. (auth)

28538 A NOTE ON THE DEUTERIUM CONTENT IN THE ATMOSPHERE AND THE HYDROSPHERE. Y. Miyake and S. Matsuo (Meteorological Research Inst., Tokyo and Tokyo Univ.). Papers Meterol. Geophys. (Tokyo), 13: 245-59(Dec. 1962).

The deuterium content in water in the primitive ocean was estimated under the assumption of gradual accumulation of oceanic waters at a constant rate, which is a difference of supply from the earth's interior and loss of water through photo-dissociation followed by escape of hydrogen into outer space. Results of calculation showed that the deuterium content in the primitive ocean was 3 to 4% less than that in the present surface water. No significant correlation was found between deuterium content, salinity, and depth, except for distributions in sea areas where the rate of evaporation exceeded considerably that of precipitation or where the sea water was mixed with a greater amount of melt water. The deuterium content of meteoric water was studied. Fractionation between both vapor-liquid and vapor-ice systems were calculated. The latter was considered more important in determining the deuterium content of rain water. It was also noted that the fractionation factor of deuterium and protium in vapor-ice system reaches its maximum at about −5°C (at 0°C for vapor-liquid system) and the vapor pressure of HDO ice is higher than that of H_2O ice for temperatures below −25°C. A balance sheet of deuterium on the earth was made together with the transfer rates among different reservoirs of water. As a result, it was concluded that concentration of deuterium in oceanic rain water (−6.9%) is 2% higher than that in continental rain (−8.9%) and 55% of water in rain on land is derived from the vapor coming from the oceans. (auth)

Natural Radioactivity and Fallout

Refer also to abstract 27932.

28539 (NP-14730) VYPADENIE STRONTSIYA-90 NA POVERHNOST TERRITORII SSR V CHETVERTOM KVARTALE 1961 G I PERVOI POLOVINE 1962 G. (Fallout of Strontium-90 on U.S.S.R. Territory in the Last Quarter of 1961 and the First Half of 1962). V. M. Shubko and A. M. Eremicheva (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR). 1963. 6p. Dep.(mn).

Tabulated data are given on the monthly fallout of ^{90}Sr in the USSR during the latter part of 1961 and the first half of 1962. (R.V.J.)

28540 (TID-21892) MEASUREMENT OF RADIOACTIVE FALLOUT BY FIELD TOTAL ABSORPTION GAMMA RAY SPECTROSCOPY. Report No. 1. (Texas Instruments Inc., Dallas. Science Services Div.). Sept. 30, 1963.

Contract AT(40-1)-3147. 98p. Dep.(mn); $3.00(cy), 2(mn) CFSTI.

Gamma ray spectral analyses of terrestrial background radiation was carried out for the period December 22, 1962 to December 31, 1963, inclusive. The data presented were gathered from December 22, 1962 through July 20, 1963, at a field location in Dallas, Texas. Spectra were reduced to the amounts of each statistically recognizable gamma-emitting radioisotope with each radioisotope followed as a function of time. This report covers (1) the method used for gamma spectral reduction by computer techniques, (2) results of the time variation of seven of the nine separated isotopes, (3) correlation of weather information to the variation of the isotopes. Results of seven months of accumulated data are included. These results show an average 4 percent diurnal variation in the amounts of ^{208}Tl and an average 20 percent diurnal variation in the amounts of ^{214}Bi. Measured nuclear fallout gamma radiation varied with the rainfall amounts and half-life decay. ^{140}Ba–^{140}La, present initially, was statistically zero by July, whereas ^{95}Zr–^{95}Nb, ^{144}Ce–^{144}Pr, and ^{137}Cs continued to build up at a rate slightly greater than the loss caused by decay. ^{131}I, also present initially, disappeared statistically by January, 1963, and was not identified again. (auth)

28541 SOME CONSIDERATIONS ABOUT THE MECHANISM OF RAIN-OUT AND WASH-OUT OF RADIOACTIVE PARTICLES IN THE ATMOSPHERE. G. Malkowski (Freie Universitat, Berlin). Atomkernenergie, 10: 151-2(Mar.-Apr. 1965). (In German)

It is shown, that not only rain-out and wash-out act in showers and thunderstorms. Below a precipitation cell strong downdrafts of some ten miles per hour occur; these downdrafts act as a "blow-out" of radioactive particles and may concentrate these particles in a shallow layer of cold and wet air near the ground. (auth)

28542 STUDY OF THE EMANATION FROM NATURAL ROCK DEPOSITS IN NON-STATIONARY STATE. Istvan Elek, Pal Mueller, and Istvan Vados. Atomtech. Tajekoztato, 8: 191-200(1965). (In Hungarian)

Since radiometric uranium ore determinations deviate sharply from the actual ore concentrations, complex investigations were made on the clarification of the emanation condition of rocks found in the natural state. It was determined that the emanation phenomena depend on the lithology, stratification, and structure. The types of rocks with different emanations are separable with special measurements and therefore the accuracy of the radiometric quality determinations can be checked by suitable corrections. The role of the anomalies of the free radon detected in the layers containing organic materials is discussed. The possibility of the correlation of emanation capacity with the equilibrium state of the area, of the emanating materials, and of the radioactivity is also discussed. The transient pattern of the emanation phenomena produced by weathering of the radon reservoir was derived. (tr-auth)

28543 INVESTIGATION OF INITIAL Sr^{87}/Sr^{86} RATIOS IN THE SIERRA NEVADA PLUTONIC PROVINCE. P. M. Hurley (Massachusetts Inst. of Tech., Cambridge), P. C. Bateman, H. W. Fairbarin, and W. H. Pinson, Jr. Geol. Soc. Am. Bull., 76: 165-74(Feb. 1965).

One to three whole-rock samples from each of more than a dozen discrete plutonic intrusions in the east-central Sierra Nevada batholith were analyzed for ^{87}Sr/^{86}Sr and Rb/Sr ratios to obtain information on initial ^{87}Sr abundances. The initial ^{87}Sr/^{86}Sr ratios in the rock magmas forming this province appear to have been in the range 0.7073 ± 0.0010 in the majority of cases. Thus, it seems clear that the Sierra Nevada magmas were not derived solely either from the typical source regions of oceanic basalt or from the melting of ancient crustal sial. It is possible that these magmas represent a mixture of oceanic basalt and crustal sial, as would be the case of anatexis in a geosyncline containing much volcanic material of fairly recent origin and some terrigenous sialic detritus. They may instead be of mantle derivation with admixtures of crustal material assimilated during their rise. The whole-rock Rb-Sr age results indicate that the Lamarck and Mount Givens Granodiorites and the alaskite of Evolution Basin and porphyritic biotite granite of Dinkey Lakes form a younger group of intrusive rocks of 90 ± 10 m.y. Although the sampling was not designed for isochron age studies, it appears that most of the remaining rock units are considerably older. (P.C.H.)

28544 CONCENTRATION OF RADIOACTIVE PARTICLES IN THE ATMOSPHERE AT VARIOUS ALTITUDES. P. Cagnetti (Comitato Nazionale per l'Energie Nucleare, Rome). Minerva Nucl., 9: 11-13(Jan.-Feb. 1965). (In Italian)

Determinations of atmospheric radioactivity due to fission products from nuclear explosions yielded interesting values in samples collected at high altitudes. Data from various Italian collecting stations are presented and corrected for normal pressure; the results are discussed in regard to their meteorologic significance in radioprotection. (auth)

28545 A STUDY OF GAMMA RADIATION IN THE REGION OF THE CENTRE FOR NUCLEAR STUDIES OF CASACCIA. O. Ilari, A. Marzocchi, and S. Tagliati (Centro Nazionale Energia Nucleare, Casaccia, Italy). Minerva Nucl., 9: 67-75(Mar.-Apr. 1965). (In Italian)

A brief description is given of the significance of a survey of background γ radiations, both in the case of normal operative conditions and in that of nuclear accident. The criteria used in organizing the study are then described (choice of position for measurement points, types of instruments adopted, etc.). Presentation of the results of the measurements provides the starting point for a comparative study of the characteristics of the different types of portable instruments for measuring γ radiations and the differences of response in comparison with background γ radiations. The definitive results of the survey are then reported. These were worked out on the basis of the above comparative study of the instruments. (auth)

28546 CORRELATION BETWEEN THE STRONTIUM-90 AND CESIUM-137 ACTIVITY IN THE FALL-OUT, IN THE GRASS AND IN MILK IN THE ISPRA AREA FROM 1962 TO 1963. M. De Bortoli, P. Gaglione, A. Malvicini, and E. Van Der Stricht (Euratom, Ispra, Italy). Minerva Nucl., 9: 76-8(Mar.–Apr. 1965). (In Italian)

The mean yearly concentrations of ^{90}Sr and ^{137}Cs in the grass and milk of some villages near Ispra, and in the fallout collected during the period 1962 to 1963 are reported. A number of proportionality factors among these values were calculated that are especially important for the elucidation of the mechanisms by which radioactive contamination can be transferred from the environment to man. (auth)

28547 SOME RESULTS OF MEASUREMENTS BY THE NETWORKS FOR THE CONTROL OF RADIOACTIVITY IN THE FALLOUT, IN SEA WATER, AND IN THE SEA FAUNA. L. Argiero, S. Manfredini, and G. Palmas (CAMEN, Pisa, Italy). Minerva Nucl., 9: 99-103(Mar.-Apr. 1965). (In Italian)

Some results of measurements by the networks for the control of fallout radioactivity in sea water and in sea fauna are presented. The development of the three national networks is discussed and the methods adopted for the collection, treatment, and measurement of the samples are described. (auth)

28548 IS THE EARLY EVOLUTION OF LIFE RELATED TO THE DEVELOPMENT OF THE EARTH'S CORE? Carl Sagan (Harvard Univ., Cambridge, Mass. and Smithsonian Astrophysical Observatory, Cambridge, Mass.). Nature, 206: 448(May 1, 1965).

It has been previously suggested that the geomagnetic field strength was insufficient to deflect charged particles from the Sun some 3×10^9 years ago. The resulting intense flux of charged particles at the surface made the origin and evolution of life impossible prior to 2.5×10^9

years ago. The argument is presented that the existence of an atmosphere of 10^{-2} atm, which is believed to have existed at this time, is sufficient to absorb a solar proton wind of contemporary energy distribution. Also, it has been found that the bombardment of simulated primitive reducing atmospheres by charged particles is an efficient mechanism for the production of organic molecules of contemporary biological significance. (W.L.G.)

28549 PRECIPITATION AS A CAUSE OF SEASONAL AND LATITUDINAL VARIATIONS IN RADIOACTIVE FALLOUT. T. Hvinden, A. Lillegraven, and O. Lillesaeter (Norwegian Defence Research Establishment, Kjeller). Nature, 206: 461-3(May 1, 1965).

A simple fallout model is presented that illustrates qualitatively the influence of precipitation on air activity and deposition. Mean concentration values for ^{137}Cs in ground-level air from seven Norwegian measuring stations showed that a seasonal minimum in precipitation was followed by a maximum in air activity. Although other geophysical processes cause variations in air radioactivity, it is concluded that precipitation is a necessary part of the complete fallout picture. (H.G.D.)

28550 RADIOACTIVE FALLOUT IN JAPAN AND ITS BEARINGS ON METEOROLOGICAL CONDITIONS. Y. Miyake, K. Saruhashi, Y. Katsuragi, and T. Kanazawa (Meteorological Research Inst., Tokyo). Papers Meteorol. Geophys. (Tokyo), 11: 151-8(Nov. 1960).

The relation between radioactive fallout and meteorological conditions was studied. The relation of rainfall amount to fallout (R) can be expressed fairly well by the formula $R = C(1 - e^{-\beta P} + \kappa P)$, where P is the amount of rainfall, C is the air activity, β and κ are constants. There is little correlation between the surface weather conditions and fallout while a considerably higher correlation was found among a trough at 500 mb, position of jet stream, and air activity. The activity increased remarkably when a trough at 500 mb passed above or when a core of a jet stream was located above or a little south of an observation point. The analytical results of ^{90}Sr deposition in Japan since 1954 and its seasonal variation are also discussed. (auth)

28551 VARIATIONS IN $^{39}K/^{41}K$ RATIO AND MOVEMENT OF POTASSIUM IN A GRANITE-SHALE CONTACT REGION. G. D. L. Schreiner and A. A. Verbeek (Univ. of Natal, Brazil). Proc. Roy. Soc. (London), Ser. A, 285: 423-9(May 4, 1965).

The ratio of the two isotopes ^{39}K and ^{41}K was measured in the Cape Granite, the Malmesbury Sediments, and in the contact regions around xenoliths of the sediments in the granite. The average value of the ratio in the granite was 13.96 ± 0.04, in the sediments 14.21 ± 0.04, and in a reference standard of potassium sulfate 14.19 ± 0.01. (Errors quoted are standard errors and the values were not corrected for mass discrimination in the spectrometer source.) An unaltered xenolith showed a zone of about an inch in the sediments with an abnormally high $^{39}K/^{41}K$ ratio (14.60 ± 0.05). Other unaltered xenoliths showed normal sediment values away from their edges. A granitized xenolith showed abnormally high values, with the maximum value (14.67 ± 0.07) near the center, 2 ft from the contact. On the granite side of the contacts of either kind, no variation in the ratio was found. The measurements were consistent with the transfer of potassium from the granite to the sediments, followed by a localized metamorphism. The granite magma could not be far above its solidification temperature and yet must have preserved some degree of mobility. (auth)

28552 AN ACCOUNT OF THE MAJOR PULSES OF TRITIUM AND THEIR EFFECTS IN THE ATMOSPHERE. Erik Eriksson (International Meteorological Inst., Stockholm). Tellus, 17: 118-30(Feb. 1965).

Tritium produced since 1954 during bomb tests was by and large injected into the stratosphere. The exact amounts are not known but various estimates agree reasonably well. The fate of the bomb-produced tritium is discussed in some detail, and it appears that ocean surfaces are very effective for withdrawing atmospheric tritium. Available data on rainfall concentrations are also reviewed, as well as various models put forth to explain the transport of tritium in nature. (auth)

28553 SIMULATION OF FALLOUT GAMMA-RADIATION FIELDS BY MONOENERGETIC PLANE ISOTROPIC SOURCES. R. L. French (Radiation Research Associates, Inc., Fort Worth, Tex.). Trans. Am. Nucl. Soc., 8: 193 (May 1965).

Techniques and Equipment

Refer also to abstracts 28241 and 29221.

28554 (AD-607491) STUDIES OF THE EFFECT OF DEPTH OF FOCUS ON SEISMIC PULSES — ESTIMATION PROCEDURE FOR FOCAL-DEPTH DETERMINATION OF SEISMIC DISTURBANCES. Special Technical Report. Stephen C. Merdler (Pennsylvania State Univ., University Park. Dept. of Geology and Geophysics). Sept. 8, 1964. Contract AF19(628)-238. 114p. (AFCRL-64-755). $4.00 (CFSTI).

A new data processing technique is suggested to estimate the delay time between initially uptraveling energy which is reflected once at the earth's surface and initially downtraveling energy on earthquake seismograms. The method uses optimum inverse filters together with a criterion that measures the simplicity of a seismic signal convolved with an inverse filter. The technique was applied to band-limited synthetic signals that contained several primary-secondary pairs in the presence of random noise. Of 27 synthetic signals which were analyzed, the procedure successfully selected the correct delay time in 22 cases. Four actual earthquake seismograms were then analyzed. The procedure selected a delay time for each earthquake. Focal depths computed from the selected delay times appeared quite reasonable when compared with depths for the same earthquakes published by the United States Coast and Geodetic Survey. In all cases, the inverse filter designed for the selected delay time considerably simplified the original seismogram. It is concluded that the technique provides a reasonable estimate of the delay time between primary and surface reflected energy. (auth)

28555 (AD-612711) PROJECT DRIBBLE — SALMON EVENT, VOLUNTEER TEAM PROGRAM. R. A. Weisbrich (Geotechnical Corp., Garland, Tex.). Feb. 17, 1965. Contract AF33(657)-12145. 51p. (TR-65-17) $3.00(CFSTI).

The Volunteer Team Program was established in 1960 to facilitate the participation of oil companies, universities, research organizations, and other scientists in the VELA-UNIFORM research program. Sixty-two teams participated in the Program for SALMON and 38 of these monitored the event. Twenty-three teams withdrew from the program before SALMON was detonated. This report describes the purpose of Project DRIBBLE and of the SALMON event which is one of three nuclear test detonations planned for Tatum Dome, Mississippi. It also describes the part which the Volunteer Teams took in monitoring this explosion and the results they obtained. (auth)

28556 (VUP-2100) MEASUREMENT OF CLOSE-IN EARTH MOTION. Preliminary Report. L. M. Swift (Stanford Research Inst., Menlo Park, Calif.). Oct. 20, 1961. Project 1.2 [of] NOUGAT SERIES, ANTLER EVENT. 46p. (SRI-1-174); VESIAC-5359VU)

Surface measurements of acceleration, velocity, displacement, and strain were made in three azimuthal directions at the surface of Rainier mesa, above Antler shot. These measurements were made with gages designed specifically to measure each quantity, and usable data were obtained from each gage. The results show pronounced spalling of the near-surface formations at distances of at least 1500 feet from surface zero. The depth of the spall, or whether it was single or multiple, is not evident, but some indications may be obtainable from further analysis.

The magnitude of the motions observed were similar to or larger than corresponding motions from shot Rainier, although Antler was buried 50 percent deeper than Rainier. From these observations, it appears that the yield of Antler was more than three times that of Rainier, or that the coupling was more effective on Antler. Considerable asymmetry was observed at different azimuths, expecially in the residual displacements. This may have been purely a surface effect. (auth)

28557 (SC-T-65-733) ELECTROMAGNETIC SIGNAL OF UNDERGROUND EXPLOSIONS. J. Ecollan and Y. Rocard. Translated by Marcel I. Weinreich (Sandia Corp., Albuquerque, N. Mex.), from Compt. Rend., 256: 237-9 (1963). 4p. Dep.(mn); $1.10(fs), $0.80(mf) JCL.

A discussion is presented of the mechanism of an electromagnetic emission which is the only important, though weak, emission in the case of the detonation of a buried charge. (auth)

28558 THE VISIBLE REGION ABSORPTION SPECTRA OF RARE-EARTH MINERALS. John W. Adams (Geological Survey, Denver). Am. Mineralogist, 50: 356-66(Mar.–Apr. 1965).

Certain rare-earth elements, notably neodymium, praseodymium, erbium, and holmium, produce absorption bands in the visible region of the spectrum when present as trivalent ions in solutions or compounds. In crystalline minerals these bands may be almost line-like and have a distribution pattern that is influenced by structure, composition, and optical direction. Bands of neodymium and praseodymium characterize cerium group minerals whereas bands of erbium and holmium commonly predominate in yttrium group minerals. Detection of the bands with a microspectroscope is invaluable for the recognition of minerals containing rare earths, but the variability of lanthanide content may preclude use of these bands for identification of individual species. In metamict minerals that show absorption spectra the bands are broad and diffuse but sharpen noticeably after heating. Absorption spectra can be obtained from some minerals only after fusion with a suitable flux. (auth)

28559 LOGGING OF BOUNDARIES BETWEEN GAS AND OIL USING TWO NEUTRON GAMMA INDICATORS OF DIFFERENT LENGTHS. Janos Deres. Atomtech. Tajekoztato, 8: 201-6(1965). (In Hungarian)

Since the penetration depth of neutron depth indicators depends upon the indicator length, the gas–oil boundary in hydrocarbon mixtures can be detected directly by means of probes of different length. The hydrogen content of the hydrocarbon is first measured with the shorter probe and the permeable layers show an almost equal deflection. By measurements of the longer probe where the indicators were affected by the zone not tangent to the sludge and the hydrogen concentration of the oil or water containing layers–in opposition to the gas layer–is less altered, these latter can be separated clearly. A standard value, drag velocity, and time constant were determined. The evaluation is made visually or graphically. The graphic evaluation has the advantage that more conclusions can be drawn from the measurement. (tr-auth)

28560 INVESTIGATION OF DRILLINGS FOR COAL DEPOSITS BY NEUTRON ACTIVATION. Karoly Sebestyen. Atomtech. Tajekoztato, 8: 207-17(1965). (In Hungarian)

The geophysical methods are a good auxiliary to the general analysis of strata; they give however almost no direct relations with the quality of the coal stratum. The exception is the γ-γ method with which the volume weight can be correlated with the ash content (or with other coal characteristics). The continuing activation of the ^{27}Al occurring in the compounds of the ashing components gives another method that refers directly to a physical or chemical characteristic of the coal. The Hungarian coals can be divided into two groups on the basis of the ashing constituents: the lime type and kaolin-clay type. The Al content of both types is at a minimum however in comparison with their surroundings. The possibilities of the method were investigated and the interfering effects of individual elements were established. (tr-auth)

28561 PROBLEMS OF METHODOLOGY AND INTERPRETATION IN THE NUCLEAR DRILLING MEASUREMENTS. Gyula Dankhazy and Laszlo Marko. Atomtech. Tajekoztato, 8: 218-28(1965). (In Hungarian)

Problems of the strata boundary dislocations determined by the nuclear profile were compared with the electrical profile. The advantages and the disadvantages of three integration methods are discussed with respect to the statistical deviations. The three methods were the rate meter, pulse integration with time, and pulse integration with distance. If the second and third methods are combined, quotients can be formed through which the dislocations of the strata boundaries are detectable as statistical oscillations. (tr-auth)

28562 APPLICATION OF THE RADIOACTIVE METHOD IN THE TESTING OF ARTIFICIAL NITRO GAS RESERVOIRS. Istvan Czegledi. Atomtech. Tajekoztato, 8: 229-37(1965). (In Hungarian)

The industrial consumption of gas increases significantly the requirements on the planning of natural gas reservoirs. In the case of large volume consumption this is possible only through artificial underground gas reservoirs. The problems of the industrial geophysical testing of subterranean reservoirs are considered, and the possible methods of gas reservoir research in various constructions were investigated. On the basis of the measurement results, an optimum method was determined. The measurement methods are also usable in the testing of natural gas reservoirs. (tr-auth)

28563 IMPROVEMENTS IN DIRECT CURRENT ELECTRICAL PROSPECTING USING THE "VECTER." R. Pochet. Bull. Inform. Sci. Tech. (Paris), No. 88, 45-53 (Nov.-Dec. 1964). (In French)

Electrical prospection has made an important contribution to research and to the development of uranium deposits. After a brief review of the principles and methods of electrical prospection, portable equipment of an original design that is easy to use even under conditions where conventional equipment would be useless are described. It was possible thereby to improve considerably the quality and the efficiency of several resistivity campaigns. (J.S.R.)

28564 ISOTOPIC AGES OF MINERALS FROM GRANITIC ROCKS OF THE CENTRAL SIERRA NEVADA AND INYO MOUNTAINS, CALIFORNIA. R. W. Kistler, P. C. Bateman, and W. W. Brannock (Geological Survey, Menlo Park, Calif.). Geol. Soc. Am. Bull., 76: 155-64(Feb. 1965).

Potassium-argon ages of biotite and horn-blende from specimens of 17 granitic plutons in the central Sierra Nevada and the western Inyo Mountains, California, range from 69 to 183 m. y. The Mount Givens, Lamarck, and Round Valley Peak Granodiorites and related younger and more felsic quartz monzonites represent a pulse of magma emplaced in the general time interval of 80–90 million years ago, during Cretaceous time. Mineral ages of granitic rocks that flank these plutons on both the east and the west have been reduced during the emplacement of the Cretaceous intrusive rocks and are minimum ages for the time of crystallization. The ages of hornblende from the Tinemaha Granodiorite (150 to 180 m. y.) may approach crystallization dates. In conjunction with ages for other intrusive rocks in the Sierra Nevada and adjacent desert ranges they strongly suggest a magmatic episode during the Early Jurassic. (auth)

28565 SAMPLING POLAR ICE FOR RADIOCARBON DATING. Chester C. Langway, Jr. (Army Cold Regions Research and Engineering Lab., Hanover, N. H.), Hans Oeschger, Bernhard Alder, and Andre Renaud. Nature, 206: 500-1(May 1, 1965).

Methods and techniques of sampling, handling, and processing unaltered glacier ice to extract the carbon dioxide component of the occluded atmospheric gases are described. Duplicate ice samples were processed by two completely different methods for the purpose of cross-

checking the results and evaluating the efficiencies of the various techniques, procedures and extraction methods used. (W.L.G.)

28566 RADIOISOTOPE MEASUREMENTS OF THE GROUND WATER FLOW DIRECTION BY THE SINGLE-WELL METHOD. Marian Borowczyk (Geological Inst., Warsaw), Jerzy Grabczak, and Andrzej Zuber. Nukleonika, 10: 19-33(1965).

Fundamental problems concerning the determination of the direction of ground water flow by means of a single-well method i.e., the choice of the radioisotope, the injection procedure of the latter, and the procedure of placing the probe in the bore-hole are discussed. A graph for the determination of the minimum period between the injection and the start of measurement is also given. The results of experiments on a model and in field conditions are presented. The results of field measurements are in good agreement with those carried out by other methods. It seems that the flow direction measurements by means of the single well method for any aquifers will be more convenient than those obtained by other methods. It is also expected that in the case of a complicated system of aquifers more information can be obtained in this way than was possible up to now. (auth)

28567 COMPENSATION OF THE COMPOSITION DEPENDENCE OF GAMMA-SCATTER GAUGES FOR MEASURING SOIL DENSITY. L. F. Ballard and R. P. Gardner (Research Triangle Inst., Durham, N. C.). Trans. Am. Nucl. Soc., 8: 68(May 1965).

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Refer also to abstract 29470.

28568 (CEA-R-2720) LES POSSIBILITES D'APPLICATION DE LA METHODE GAMMA-GAMMA A LA DETERMINATION EN PLACE DE LA DENSITE DES MINERAIS D'URANIUM. (Possibility of Applying the Gamma-Gamma Method to the In Situ Determination of Uranium Ore Densities). Jan. Czubek (Institute of Nuclear Research, Krakow (Poland)) and Jean Guitton (Commissariat à l'Énergie Atomique, Saclay (France). Centre d'Études Nucléaires). Mar. 1965. 32p. Dep.(mn).

The principles of the gamma-gamma method are reviewed. It is shown in particular that, under certain conditions, the method makes it possible to obtain a representative measurement of the electronic density. Chemical analyses have been carried out on samples obtained from uranium deposits. The results show that an exact correlation exists between the massive and electronic densities. It is possible to consider the possibility of measuring the density of uranium-containing rocks by the gamma-gamma method. (auth)

28569 RADIOACTIVE EQUILIBRIUM OF URANIUM ORES. R. Coulomb. Bull. Inform. Sci. Tech. (Paris), No. 88, 55-60(Nov.-Dec. 1964). (In French)

The measurement of the radioactive equilibrium in ores or uranium-containing anomalies, in particular a knowledge of the ratios $^{230}Th/^{238}U$, $^{226}Ra/^{238}U$, $^{231}Pa/^{235}U$, $^{230}Th/^{232}Th$, provides geologists with very useful information concerning geochemical phenomena in the weathering-zone, the direction and size of uranium migrations, the age of recent deposits, and circulation channels. Although delicate, these techniques are now being applied successfully to many field problems. (J.S.R.)

28570 EVALUATION OF THE GEOLOGICAL CONTROL IN THE LES BRUGEAUDS QUARRY. J. Barreau. Bull. Inform. Sci. Tech. (Paris), No. 88, 69-79(Nov.-Dec. 1964). (In French)

The situation and geology of uranium deposits at Les Brugeauds are briefly described. The method for evaluating the ore and the metal content in the quarry, using the preliminary mining work with percussive drilling in particular and geological control during the working of the quarry (ore-sorting, evaluation of the products) is discussed. (J.S.R.)

28571 IMPROVEMENTS IN AND RELATING TO THE LOCATION OF URANIUM ORE DEPOSITS AND APPARATUS THEREFOR. (to Union Carbide Corp.). British Patent 987,462. Mar. 31, 1965. Priority date June 26, 1961, United States.

A method and apparatus are described for the location of uranium deposits that is suitable for both vertical and horizontal prospecting methods with the drill holes spaced up to half a mile apart. The apparatus may be readily transported by a truck or carried by one man. A hole is drilled into the substrata region to be probed; after a portion of the hole is sealed off, the gas present in the substrata region is evacuated through a radon absorbing means; and the quantity of radon absorbed is measured by radiometric means to provide a measure of the amount of uranium producing the radon. (B.L.M.)

HEALTH AND SAFETY

See also BIOLOGY AND MEDICINE — Radiation Hazards and Protection.

Refer also to abstracts 28218, 28420, 28706, 29505, 29507, and 29716.

28572 (AHSB(S)R-84) SAFETY IN THE USE OF GAS CYLINDERS. E. W. F. Whalley (Authority Health and Safety Branch, United Kingdom Atomic Energy Authority, London (England)). 1965. 19p. Dep.; $0.90(BIS); 4s. 6d. (HMSO).

Regulations model safeguards for the storage, handling, use, and transport of gas cylinders are presented. It is hoped that, where there is a need, individual establishments will be able to make these safeguards a basis for local instructions. Since no set of rules can cater for every contingency, it is recommended that local instructions include a statement that the site safety organization should be consulted in any case where doubt exists as to correct procedure. (auth)

28573 (AP-Note-439) AIRBORNE ACTIVITY SAMPLING PROGRAM, SUBTASK 8.2. J. F. Cox (Alco Products, Inc., Schenectady, N. Y. Nuclear Power Engineering Dept.). June 22, 1962. Contract AT(30-1)-2639. 17p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

The necessity for characterizing, in detail, airborne activities being discharged from Army nuclear power plants is discussed. A preliminary system is presented. A technique for quantitatively measuring gaseous airborne activity levels is discussed in detail. (auth)

28574 (BMI-X-10119) AN EVALUATION OF THE APPLICABILITY OF EXISTING DATA TO THE ANALYTICAL DESCRIPTION OF A NUCLEAR-REACTOR ACCIDENT. Quarterly Progress Report, January–March 1965. Duane N. Sunderman, David L. Morrison, James A. Gieseke, John C. Smith, and Craig T. Walters (Battelle Memorial Inst., Columbus, Ohio). Apr. 1, 1965. Work Performed under United States–Euratom Joint Research and Development Program. Contract W-7405-eng-92. 20p. (EURAEC-1369). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Work on digital-computer programs for analysis of loss-of-coolant accidents continued during the period. Development of methods for calculation of temperatures, change of heat-generation rates, and change of convection coefficient is reported. Data from studies of fission-product release from UO_2 are being evaluated. Information on release of I_2, Xe, and Ru from irradiated UO_2 is summarized. Work on models to predict aerosol transport and deposition is reported. (J.R.D.)

28575 (BNL-9173) CHEMICAL REACTIONS AND TRANSPORT BEHAVIOR OF FISSION-PRODUCT IODINE. A. W. Castleman, Jr., I. N. Tang, and H. R. Munkelwitz (Brookhaven National Lab., Upton, N. Y.). Apr. 1965. Contract AT-30-2-GEN-16. 24p. (CONF-650407-2). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From International Symposium on Fission Product Release and Transport under Accident Conditions, Oak Ridge, Tenn.

An experimental study was made of the chemical states of iodine release from irradiated U and hypostoichiometric UC at high temperatures. The iodine species, determined using a thermo-chromatographic apparatus, were found to be elemental I_2 and a uranium subiodide. An equation was derived for the fission-product condensation in a thermal gradient. Experiments were conducted on the diffusion of iodine in hypostoichiometric UC at 1400 to 1800°C. (D.L.C.)

28576 (UCRL-12167) HAZARDS CONTROL QUARTERLY REPORT NO. 18, JULY–SEPTEMBER 1964. (Lawrence Radiation Lab., Univ. of California, Livermore). Contract W-7405-eng-48. 63p. Dep.; $3.00(cy), 2(mn) CFSTI.

A curve for a six-stage Andersen cascade impactor was plotted to show the effective cutoff diameter of unit-density particles as a function of flow rate for each stage. Phantom calibration methods and results of 58 human measurements for ^{40}K are presented. A furnace was built and operated to simultaneously grow five single crystals of LiF with selected impurities. Maximum and mean ranges and relative stopping powers of ^{238}Pu alpha particles in various materials are presented. A neutron REM counter was evaluated and found to read RBE dose rate to ±10% in the intermediate energy region. A 12-station, portable sequential air sampler for radioiodine was designed and built. A method for determining diffusion coefficients was developed to detect particulates in radioiodine aerosols. A description is given of the LRL laser eye protection program including a discussion of eye protective devices and the importance of operator training. Tests reveal that fire hose quality has improved resulting in new friction characteristics. A test developed to determine the early sensitivity to perchloric acids of organic materials was applied to a number of products used or proposed to use in perchloric acid enclosures. An instrument was developed which appears to be suitable for remote monitoring of explosive atmospheres. Exposure of flooring materials, sealants, and adhesives to outdoor weathering and light traffic for periods of up to four years shows (1) that epoxy formulations and certain vinyl strip coats are durable, and (2) that epoxy-presealed concrete will protect a linoleum-adhesive bond against failure through water intrusion. (auth)

28577 (UCRL-12378) HAZARDS CONTROL QUARTERLY REPORT NO. 19, OCTOBER–DECEMBER 1964. (Lawrence Radiation Lab., Univ. of California, Livermore). Contract W-7405-eng-48. 20p. Dep.; $1.00(cy), 1(mn) CFSTI.

Comparative and absolute background measurements of the developmental type-C70145 photomultiplier are presented. Calibration methods for ^{137}Cs whole-body counter are discussed, and results of analyses for ^{137}Cs and K are presented. Experiments show that 0.005-in. polyethylene jackets provide adequate protection for personnel monitoring film badges exposed to high humidity. A slit draped hood was devised to provide protection when neither a glove box nor an open hood is entirely adequate. Demisters were found to be ineffective for arresting high expansion foam. (auth)

28578 (WT-1173) EFFECTS OF ATOMIC WEAPONS ON ELECTRIC UTILITIES. Nevada Test Site, February–May 1955. Ralph V. H. Wood, Arthur C. Werden, Jr., and Russel L. Berg (Edison Electric Inst., New York and Federal Civil Defense Administration, Battle Creek, Mich.). Project 35.1 [of] OPERATION TEAPOT. 46p. Dep.; $2.00 (cy), CFSTI.

Duplicate electric-power installations consisting of transmission, substation, and distribution equipment were constructed in areas 4700 and 10,500 ft from Ground Zero for use in Project 35.1 in the Apple II shot. The test was made to determine the median survival range of the electric equipment; the extent of damage and the nature of the repairs required to restore disrupted service; and the ability of electric systems, in comparison to industrial plants and the residential communities they serve, to withstand the effects of an atomic explosion. The damage was confined to the transmission and distribution circuits at the 4700-ft area and was of such a nature that the equipment could have been easily and quickly repaired. In the same area, typical homes were completely destroyed. (auth)

28579 (UCRL-Trans-1085(L)) MECHANICAL STRENGTH AND FIRE-CHECKING CHARACTERISTICS OF HIGH-EFFICIENCY PARTICULATE FILTERS. Kenneth D. Mulcaster. Translated by Sergey Shewchuck (Univ. of California, Livermore), from Staub, 23: 64-9(1963). 26p. Dep.(mn); $2.60(fs), $0.98(mf) JCL.

In addition to the mechanical stresses, the high-efficiency filters in ventilating systems can also be exposed to flame effects which impair their performance capability. Methods are described on how these stresses are imitated and how they can be used for production tests. The results which were found from these tests on high-efficiency particulate filters are reported. As fire protection for the high-efficiency filters there were studied in these tests different prefilters (antefilters) and prefilter-combinations. It is shown that with a certain combination, an almost complete fire protection of the main filter can be achieved. Finally a new method is described for quick, accurate, and reproducible testing of high efficiency filters, the photoelectric sodium chloride flame test. (auth)

28580 RADIATION DOSE FROM DIAGNOSTIC MEDICAL X-RAY PROCEDURES TO THE POPULATION OF NEW YORK CITY. M. B. Heller, H. Blatz, B. Pasternack, and M. Eisenbud (New York Univ., New York). Am. J. Public Health, 54: 1551-9(Sept. 1964).

Data are presented on the results of a survey designed to collect information on the kind, operational state, and number of diagnostic and therapeutic x-ray units in New York City; estimate the frequency of various medical procedures which involve diagnostic and therapeutic radiation exposure to residents of New York City according to equipment used, technic, specialty of physician, age and sex of patients, and seasonal variation; estimate per capita gonadal and bone marrow radiation dose to the population of New York City; and determine the feasibility of using information obtained in the objectives stated above in epidemiological studies and to identify population exposure groups for future study of possible delayed radiation effects. The direct sampling of private physicians' offices was used. Each installation was normally sampled for a period of four weeks. A total of 4847 installations was studied. While 7.2% of the x-ray units in private offices were owned by radiologists, 71% were owned by general practitioners and internists. The gonadal dose to each patient observed in the study was individually computed. The procedure consisted of first computing the field size of the x-ray beam at the patient from the cone data and target to film distance. The air dose at the patient's skin was computed as a function of kvp and target-to-skin distance. The gonadal dose was then determined by direct computation or by modification for technical and anthropometric factors and interpolation lab phantom data. Bone marrow dose was computed in a similar manner. The data presented are derived from the analysis of information collected during the year 1961. The age distribution in ten-year intervals, for all exposures is shown. Chest film exposures are indicated as a percentage of the exposures in each age interval. The over-all percentage of chest examinations was 37%. The percentage of total examinations under ages 30 (20.4%) and 40 (37.4%) are of interest, since it is estimated that 50% of all children are born to parents under 30 yr of age and 90% are born to parents under 40 yr of age. The most frequent examinations are tabulated. The mean number of exposures for all radiographic examinations was 2.37. The most frequent type of examination involved the chest. Another table summarizes the technical variables in chest radiography for several specialties. The mean ma-sec value for all specialties is 17.6. This variable, which is proportional to dose, would be reduced by 15% if appropriate intensifying screens were used for all examinations. The 28 ma-sec figure, the high kvp, and low target-to-film distance for occupational medicine reflect the extensive use of photofluorographic equipment in that specialty. The high ma-sec (21.1) value for radiology is due to the relatively larger proportion of lateral projections performed. The estimation of population radiation exposure from medical x rays based on these data indicate that many of the accepted estimates (on which population dose estimates have been based) may be low by as much as one or two orders of magnitude. These estimates are misleading because they are based on the use of optimum technic and therefore indicate what the dose should be rather than what the dose is. (BBB)

28581 LUNG CANCER AND URANIUM MINING. A CRITIQUE. Raymond Seltser (Johns Hopkins Univ., Baltimore). Arch. Environ. Health, 10: 923-36(June 1965).

There is no reason to doubt that a truly excessive lung cancer risk existed among the uranium miners in Schneeberg and Joachimsthal and that United States uranium miners, at least in the early years of this industry, were similarly exposed to excess risk of developing lung cancer. The current state of knowledge regarding the biological effects of ionizing radiation and the activity of radium decay products leads to the conclusion that the respiratory tracts of these uranium miners were subjected to prolonged local massive bombardment with α-rays which resulted in the development of lung cancer in a sizeable proportion of individuals so exposed. The type of occupational hazard existing in uranium miners is unique in the type of radiation exposure (i.e., local, α-ray, chronic exposure, massive dose) to which these men are subjected. Conditions in the mines were probably crucial in affording a type of atmospheric pollution which may have potentiated the biological effectiveness of the radon-daughter products. There is no convincing evidence in the literature to incriminate any other component of the mine environment as the major factor responsible for the excess lung cancer risk. On the other hand, there is no evidence to rule out the potential contributory role of any other component of this unusual environment. (H.G.D.)

28582 ESTIMATION OF THE γ-FLUX EFFECTED BY CONTAMINATED AIR IN WORK ROOMS. W. M. Pusch (Philips GmbH, Vienna). Atomkernenergie, 10: 139-44 (Mar.-Apr. 1965). (In German)

In order to calculate the whole-body dose to which one can be exposed in laboratories and working rooms by an atmosphere contaminated with γ emitters, it is necessary first to calculate the γ flux. On the other hand, if the geometry factor for the flux in a working room in which the specific contamination of the atmosphere should be surveyed permanently is known, it is possible to calibrate the counting rate of a counting tube in $\mu c/cm^3$. For the application of flux calculations, approximate evaluations were made for the most important configurations of working rooms. (auth)

28583 THE MAXIMUM PERMISSIBLE ACTIVITY CONTAINED IN THE EXHAUST AIR FROM A NUCLEAR PLANT. [PART] I. L. A. Koenig and S. Zehme (Gesellschaft fur Kernforschung GmbH, Karlsruhe, Ger.). Atompraxis, 11: 191-8(Apr. 1965). (In German)

A method was developed for calculating the limits of the permissible amount of activity discharge from a nuclear plant. A distinction was made between continuous and short-term discharge. For particularly important radionuclides, the limits were calculated on the basis of the recommendations of the German First Radiation Protection Ordinance (1. SSVO) and of the ICRP. (auth)

28584 THE CONTRIBUTIONS OF INTERMEDIATE NEUTRONS TO THE NEUTRON DOSE RATE EQUIVALENT OUTSIDE REACTOR SCREENS. D. Nachtigall (Kernforschungsanlage, Julich, Ger.). Atompraxis, 11: 203-8 (Apr. 1965). (In German)

Measuring dose-rate equivalents of intermediate neutrons is discussed. The procedures described in the literature require the presence of a 1/E distribution for the neutrons in this range. The difference procedure, with which the dose-rate equivalent of intermediate neutrons can be determined independently of the spectral distribution of the neutrons is described. A comparison of this method with a 1/E method showed that the latter is generally unsuitable

for use outside reactor shielding. The proportion of intermediate neutrons in the neutron dose-rate equivalent outside reactor shielding averages 40%, but can amount to over 90%. (auth)

28585 ISODOSE CURVES IN NON-UNIFORM PHANTOMS. David Greene and J. G. Stewart (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Brit. J. Radiol., 38: 378-85(May 1965).

A method of using an isodose plotter to produce isodose charts in a water phantom containing bone, lung-equivalent material, or air cavities is described. It is shown that for ^{60}Co γ rays and 4 Mv x radiation standard isodose charts can be modified to fit the experimental results by the use of a simple set of rules to an absolute accuracy of about 2 per cent. Some isodose charts for conventional quality radiation in non-uniform phantoms are also discussed, but here the effects produced by the non-uniformity are more complex than with megavoltage radiation and corrections derived from simple rules are of limited value. Rules for modifying megavoltage isodose charts are used to prepare some treatment plans for real body sections, and these are compared with conventional treatment plans where it is assumed that the body section consists entirely of soft tissue. It is shown that there is probably no clinically significant difference between the conventional and corrected dose distributions, although the absolute tumor doses found by correcting for differential absorption in lung or bone are significantly different from conventionally stated doses. (auth)

28586 RADIATION PROTECTION IN CANADA. PART VII. THE ROLE OF INDUSTRIAL HYGIENE IN THE FIELD OF RADIATION PROTECTION. N. Williams (Dept. of Public Health, Regina, Saskatchewan). Can. Med. Assoc. J., 92: 993-1001(May 8, 1965).

The main emphasis of a provincial radiation protection program is on ionizing radiation produced by machines, although assistance is given to the Federal Radiation Protection Division in its program relating to radioactive substances. The basis for the Saskatchewan program of radiation protection is the Radiological Health Act 1961. An important provision of the Act is annual registration of radiation equipment. The design of the registration form encourages a do-it-yourself radiation and electrical safety inspection. Installations are inspected every two years by a radiation health officer. Two hundred and twenty-one deficiencies were found during inspection of 224 items of radiation equipment, the commonest being failure to use personal film badges. Insufficient filtration of the beam, inadequate limitation of the beam, and unnecessary exposure of operators were other common faults. Physicians have a responsibility to weigh the potential advantages against the hazards when requesting radiographic or fluoroscopic procedures. (auth)

28587 RADIOACTIVITY OF THE MOST COMMON GRASS-LIKE PLANTS. M. Muminov (Navoi Middle Azian State Inst., USSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 5, 68-70(1964). (In Russian)

Plants growing in a soil containing radioactive materials may contain some radioactivity. This question was studied on samples of 10 species of weeds and grasses, growing at various areas zones near the University. Air-dried and calcined samples of Poa annua Z., Cynodon daetylon Z., Atriplex tatarica Z., Mentha arvensis Z., Artemisia maritima, Zygophyllum foliago Z., Polygonum aviculore Z., Copporis sinosa, and Artemisia annua Z., were subjected to measurements. The β activity a was calculated from the formula $a = (N\beta/22.2 \times 10^5 \times w\ p\ k\ s\ q)$ where Nβ designates the measured pulses/minute, w is the body angle of the counter with respect to the source, p is the average number of β particles emitted per decay event, k is the correction factor for the absorption of β particles by the walls of the counter, s is the self-absorption coefficient and q is the back-scattering factor. Spectral analytical studies revealed that the samples contained ^{40}K, ^{48}Ca, ^{90}Sr, and ^{96}Zr. No differences could be found to differentiate between the species or the place of collection. This is probably due to the uniform composition of the soil throughout the area. (TTT)

28588 SURVEY OF STATE LAWS AND REGULATIONS FOR RADIATION CONTROL. Ralph E. De Forest (American Medical Assn., Chicago). J. Am. Med. Assoc., 189: 779-83(Sept. 7, 1964).

Information is summarized on ionization radiation laws and regulations promulgated in the 50 states and the District of Columbia. Primary consideration is given to state radiation control and protection programs affecting physicians and patients. This survey was conducted to determine the status of state ionizing radiation laws and regulations in relation to their effects on health and medical practice. Of the 50 states and District of Columbia, 49 have ionizing radiation statutes. These statutes include the establishment of state coordination of atomic energy activities, state radiation control programs, and formal agreements with the Atomic Energy Commission for state regulation of isotope uses. Thirteen states have general laws which authorize a state agency to promulgate regulations for public health and welfare protection. The statutes of 19 states allow the state to establish licensing procedures. Specific statutes in 32 states authorize regulations requiring the registration of radioactive materials and radiation-producing devices. Laws of 21 states authorize the radiation agency to enter into agreements with the federal government, other states, or interstate agencies, to implement radiation control. Twenty-six state laws authorize an agreement with the Atomic Energy Commission to assume control of by-product, source, and special nuclear material in quantities not sufficient to form a critical mass. Eight states have such an agreement (Arkansas, California, Florida, Kentucky, Mississippi, New York, North Carolina, and Texas). Fluoroscopic type shoe-fitting devices are restricted in 20 states. Nine states require licensing of individuals for the use, handling, transfer, and disposal of certain radioactive materials. Eight of these are Atomic Energy Commission agreement states. Twenty-five states have Radiation Protection Standards regulations which include (a) permissible exposure levels, (b) precautionary procedures, and (c) waste disposal. Values for permissible exposure levels given in the regulations are generally the same as those set by the Atomic Energy Commission. Ten states have regulations on medical use of x rays. These regulations, not intended to limit the amount, kind, or use of x rays, provide safety rules in (a) equipment design, (b) structural shielding, (c) operating procedures. Of the 30 states with regulations establishing radiation control programs, 28 also regulate industrial uses of ionizing radiation. Generally, these rules pertain to safe exposure levels, structural shielding, and equipment design for industrial radiographic operations. (BBB)

28589 NEUTRON DOSIMETRY. Makra Zsigmond (KFKI, Budapest). Magy. Fiz. Folyoirat, 13: 1-18(1965). (In Hungarian)

The purpose of dosimetric measurements is to determine the energy emitted by a given radiation and absorbed in a medium. When choosing instruments for neutron dosimetry, the purpose of the measurements must be kept in mind. For radiation safety work, small, rugged, and portable instruments are needed. Instruments used in health physics research must be able to determine the energy distribution of the flux, differentiating between doses due neutrons of various energies. As many instruments are not available commercially, they must be constructed by the users and therefore the ease of construction and calibration must also be considered. Measurements in the 1 to 100 kev range present the greatest difficulties; accelerator-induced nuclear reactions and radioactive neutron sources may be used in these cases. In the ev to kev range, the time-of-flight method may be applied. Nuclear emulsions are widely used for personnel monitoring. The energy dependence of certain detectors, such as the ZnS type plastic scintillators, deviates markedly from that of tissue. Thermal neutron detectors, including Cd-covered films, BF_3-filled or B-covered ionization cham-

bers and counters, and thermal neutron scintillators are suited for determining slow and epithermal neutron doses but they usually underestimate fast neutron doses. (56 references). (TTT)

28590 ORGANIZATION OF PUBLIC HEALTH DURING DISASTERS. Gonzalo Gil Piedrola (Real Academia Nacional de Medicina, Madrid). Med. Trop. (Madrid), 39: 59-77(Sept.-Oct. 1963). (In Spanish)

Effects of thermonuclear weapons explosions are described, and civil preparedness against such attacks and other disasters is discussed. (BBB)

28591 DOSE OF GAMMA RADIATIONS FOLLOWING CUTANEOUS CONTAMINATION BY BETA AND GAMMA EMITTING RADIONUCLIDES. A CRITIQUE. F. Breurer and E. Casnati (Comitato Nazionale per l'Energia Nucleare, Casaccia, Italy). Minerva Nucl., 9: 88-93(Mar.-Apr. 1965). (In Italian)

A method adopted to test the validity of the formula used in a previous investigation to calculate the dose of gamma radiations absorbed by the skin is described. To achieve this, the results obtained with previously used formula were compared to those calculated to the two extreme conditions that can occur for the field: maximal diffuse radiation and no radiation. It was found that in the range of energy considered, the values for the skin dose obtained in the previous investigation are very similar to those calculated for a condition of maximal diffusion and can therefore be accepted as prudential dose values. (auth)

28592 ^{90}Sr AND ^{137}Cs IN THE PROCESS OF BUTTER- AND CHEESE-MAKING. G. G. Calapaj and D. Ongaro (Universita, Padua). Minerva Nucl., 9: 93-8(Mar.-Apr. 1965). (In Italian)

Laboratory and semi-industrial investigations were carried out on the passage of ^{90}Sr and ^{137}Cs from natural radio-contaminated milk to butter and cheese. The following points were ascertained: in butter-making, the ^{90}Sr level in the commercial products does not exceed 1% of the quantity originally present in the whole milk; if, instead of commercial butter, pure butter fat is considered, the level drops to less than 0.2%. A similar behavior is shown by ^{137}Cs, the transfer of which to butter is not greater than 1.5%. In rennet coagulation, the ^{90}Sr of the coagulum ranges from about 80% to about 20% of that present in the milk and decreases regularly with increasing acidity in a similar manner to calcium. The quantity of ^{90}Sr that passes into the coagulum is always proportionally greater than the calcium, the difference gradually dropping to zero at the isoelectric point of casein. On the contrary, the passage of ^{137}Cs from milk to coagulum is independent of acidity. The level of this radioisotope is always less than 10% of that originally present in the milk. These laboratory results were confirmed by semi-industrial tests of the production of some types of soft cheese. (auth)

28593 MEASUREMENT OF THE EXPOSURE OF HUMAN POPULATIONS TO ENVIRONMENTAL RADIATION. Wayne M. Lowder and William J. Condon (Atomic Energy Commission, New York). Nature, 206: 658-62(May 15, 1965).

Two different sets of population exposure measurements are compared and alternative methods available for such surveys are discussed. Some general conclusions relating to the state of the art that can be derived from such experience are made. The results provide a useful background for considering the general problems associated with making such measurements and interpreting them properly. It was concluded that the range of population exposure to environmental radiation is quite narrow through the regions (Vermont and New Hampshire) studied. Also, the basic limitation of the pocket ionization chamber technique in terms of measuring normal human exposure to environmental radiation was found to be difficulty in determining mean leakage rates under actual field conditions while being worn and handled. Recent advances in direct personnel dosimetry are also discussed. (P.C.H.)

28594 ON THE CONTAMINATION OF ATMOSPHERIC KRYPTON BY ^{85}Kr FROM FISSION PRODUCTS. Kazimierz W. Ostrowski and Kazimierz Jelen (Inst. of Nuclear Technique, Krakow). Nukleonika, 10: 67-8(1965).

An investigation on G-M and x-ray counters filled with krypton showed that the krypton was contaminated by ^{85}Kr from fission products in the atmosphere. The beta radioactivity of krypton gas contained in a bottle was also proved. It was concluded that this contamination can be a serious obstacle in the production of ionization detectors filled with krypton. (P.C.H.)

28595 RADIO-CONTAMINATION FROM TRITIUM TARGETS $^{3}T/Ti$ AND $^{3}T/Zr$. Edward Chrusciel (Institut Techniki Jacrowej AGH, Krakow), Jan Lasa, and Stanislaw Salach. Nukleonika, 10: 115-21(1965). (In Polish)

The activity decrease of tritium targets, which could lead to radiocontaminations is discussed. The rate of tritium evolution from tritium sources and the character of surface radiocontaminations were investigated. In these measurements a flow ionization chamber and spectrometer system were used. It was proved that besides the tritium diffusion from the target there is also a loss of activity of the target due to the mechanical factors. Possible radiological hazards from different targets are discussed. (auth)

28596 INDIRECT METHOD DETERMINING THE CONTAMINATION OF GROUND WITH FALL-OUT. Maciej Radwan, Henryk Golinczak, Jerzy Stasiuk, and Barbara Krzysiak (Military Technical Academy, Warsaw). Nukleonika, 10: 123-9(1965). (In Polish)

The concentration of strontium-90 in horns of stags derived from various places and several years was investigated. Pieces of horns were burned and samples were prepared from ash. The activity of those specimens (dry and liquid) was measured by use of several counters. It was found that the concentration of strontium-90 in horns grows with time. This can be taken as a criterium of ground contamination by fallout. (auth)

28597 RADIOLOGICAL HEALTH DATA [MONTHLY REPORT], VOLUME 6, NUMBER 4. (Public Health Service, Washington, D. C.). Apr. 1965. 65p. $0.50(GPO).

Topics discussed include: fallout contamination of air, milk, food, and water; radionuclide uptake by man; environmental levels of radioactivity at AEC installations; and reported nuclear detonations for March 1965. Separate abstracts were prepared for four contributed papers. (H.G.D.)

For abstracts of individual sections see: 28598, 28599, 28600, and 28601.

28598 DETECTION OF FALLOUT FROM CHINESE NUCLEAR TEST OF OCTOBER 16, 1964, BY THE NATIONAL AIR SAMPLING NETWORK. B. Branson, E. Tabor, G. Holzworth, S. Gold, J. Hardin, and B. Kahn. Radiol. Health Data, 6: 188-92(Apr. 1965).

Beginning October 21, 1964, air filters from the National Air Sampling Network stations were analyzed for recently formed fission products resulting from the mainland Chinese atmospheric nuclear test. Radioactivity concentrations were determined in picocuries per cubic meter of air. Significant increases in gross activity were scanned for gamma activity. Most sampling stations in the USA receive at least a trace of the fallout from the Chinese test, the highest gross beta concentrations being measured in Bismarck on October 24th and 25th, in Helena of October 23rd and 24th, and in Orlando on October 27th and 28th. The effects of precipitation and vertical mixing on distribution of radioactive debris are considered. (H.G.D.)

28599 COMPARISON OF RADIONUCLIDE CONCENTRATIONS IN MILK FROM DISTRIBUTORS SERVING THE CITY OF BOSTON. E. J. Baratta, M. A. Wall, and H. Mazer. Radiol. Health Data, 6: 212-16(Apr. 1965).

A study was designed to compare the radionuclide content of milk from each of the six major distributors, who supply a total of 99% of the fluid milk consumed in Boston.

Such a comparison would indicate whether the reported Pasteurized Milk Network average radionuclide content was representative of the milk consumed by an individual customer of any one of the six distributors. On the basis of the data it was concluded that in the city of Boston there was reasonably close agreement between the yearly average levels of strontium-90, cesium-137, and strontium-89 in the Network station sample and in the milk from each of the six major distributors serving the area. Therefore, the Network station sample offered a good estimate of the radionuclide content of the fluid milk supplied by the individual companies commercially serving the city. (H.G.D.)

28600 CESIUM-137 BURDENS IN MAN, JULY 1963 THROUGH AUGUST 1964. Frank C. Leitnaker, Richard C. Reba, and Kent T. Woodward. Radiol. Health Data, 6: 227-9(Apr. 1965).

Whole-body ^{137}Cs burdens determined by liquid-scintillation whole-body counting at the Walter Reed Army Institute of Research are presented for the period extending from July 1963 through August 1964. During this period 690 assays were performed on 628 subjects, primarily active duty military personnel. Cesium-137 body burdens were expressed as picocuries ^{137}Cs per gram potassium. Total body potassium was also determined in each subject. The state and major geographical area in which each person had lived the longest during the previous 30 months was also recorded. (H.G.D.)

28601 STABLE ELEMENTS AND RADIONUCLIDES IN HUMAN MILK. Conrad P. Straub and Gopala K. Murthy. Radiol. Health Data, 6: 230-1(Apr. 1965).

During the period July 1959 through August 1961, samples of human milk were obtained in the Denver and Chicago areas as a part of a program supported by the Division of Radiological Health. With the exception of the potassium concentrations, there was excellent agreement in the values reported for the two areas. (H.G.D.)

28602 DOZIMETRIYA RADIOAKTIVNYKH GAZOV I AZROZOLEI NA SUDAKH. (Dosimetry of Radioactive Gases and Aerosols on Ship). V. I. Zadontsev, A. A. Korcunenko, B. N. Nikolaev, and M. I. Rykov. Leningrad, Publishing House of Ship Construction, 1965.

The principal concepts of dosimetry of radioactive gases and aerosols on ships are reviewed. A systematic analysis is made of the methods and instruments used for detection and measurements of concentration of radioactive gases and aerosols and for monitoring radiation doses from contaminated air. Specific measurements required for radioactive gas and aerosol control are discussed. (R.V.J.)

28603 RECOMMENDATIONS OF THE INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION. ICRP PUBLICATION 5. REPORT OF COMMITTEE V ON THE HANDLING AND DISPOSAL OF RADIOACTIVE MATERIALS IN HOSPITALS AND MEDICAL RESEARCH ESTABLISHMENTS. New York, Pergamon Press, 1965. 55p.

Handling and disposing of radioactive materials in hospitals and small laboratories are discussed. Practices are described by which it should in general be possible to maintain radiation doses below the maximum permissible levels recommended by the Commission. Topics covered include: responsibility for radiation safety measures, medical examinations, personnel monitoring, environmental monitoring, procedures in work with sealed sources, procedures for work with unsealed radioactive materials, decontamination of personnel, decontamination of buildings and equipment, disposal of radioactive waste, storage of radioactive materials, transportation of radioactive materials, discharge of patients during treatment with radioactive materials, and disposal of radioactive corpses. Recommendations of the commission are given. (M.C.G.)

28604 THE ROLE OF THE ATOMIC ENERGY COMMISSION IN DEVELOPING RADIATION PROTECTION STANDARDS. Forrest Western (Atomic Energy Commission, Washington, D. C.). p.73-5 of "Proceedings of the American Medical Association Congress on Environment Health Problems." Chicago, American Medical Association, 1964.

The Atomic Energy Act specifications for radiation protection were interpreted by the USAEC as including broad responsibilities in all phases of radiation protection, including the development of the various kinds of information used in the formulation of standards. In addition, the AEC required radiation protection standards directly applicable to its own activities, including the operation of nuclear energy facilities and the regulation of the private use of nuclear materials and their radioactive byproducts. Biological research programs were started to study the effects of radiation on living tissue and to establish the relative effectiveness of equal doses of x rays, alpha rays, beta rays and neutrons in producing various kinds of biological damage. Ways in which the activities of the AEC relate to radiation protection standards for industry, medicine, and research are discussed. (H.G.D.)

28605 A CONSIDERATION OF BASIC RADIATION PROTECTION GUIDES APPLICABLE TO THE GENERAL POPULATION. Paul C. Tompkins (Federal Radiation Council, Washington, D.C.). p.76-81 of "Proceedings of the American Medical Association Congress on Environment Health Problems." Chicago, American Medical Association, 1964.

Trends in the development of basic standards for radiation protection applicable to the general population are considered. The introduction of the non-threshold, statistical risk concept had the effect of putting scientific judgments of dose-effect relationships and political judgments concerned with national welfare on a somewhat equal footing particularly when exposure of the general population is a factor in proposing basic radiation protection guides. Standards and judgments employed by the ICRP and the FRC in establishing radiation protection guides are discussed. (H.G.D.)

28606 CONTAMINAZIONE RADIOATTIVA (Radioactive Contamination). S. Ragusa. Rome, ENPI, 1964. 294p. 5000 Lire.

28607 FOAMGLAS SHIPPING CONTAINER (Engineering Materials). (Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant). 1 drawing. (CAPE-1199)

A drawing is presented for a container that is used for commercial shipments of dry enriched U compounds or metal. A total of forty containers can be shipped. Each container is loaded to a maximum of 20 kilograms of U containing 94.0% ^{235}U and is placed in an inner container of 4 liters volume. The container is constructed of carbon steel and is insulated with Foamglas. The drum is 22 in. high and 22½ in. ID. The inner container is 6⅝ in. OD, 9 in. deep, and is constructed of 1.25 coke plate, No. 135, tin. (For details, see TID-4100) (D.L.C.)

28608 A PROCESS FOR PREPARING A FLAME AND/OR RADIATION RESISTANT AND/OR DECORATIVE MATERIAL. Sigurd Boerre Giertsen. British Patent 985,890. Mar. 10, 1965. Priority date Dec. 7, 1962, Norway.

A process of preparing a flame and/or radiation resistant material consists of coating a web of textile, on at least one side, with a layer of metal or alloy by metal spraying with a gas pistol or electric arc pistol and then calendering the textile to compress the coating. The calendering largely improves the finish so that the reflective properties and the flame and radiation resistance of the textile is improved. (B.L.M.)

INSTRUMENTATION

General

Refer also to abstracts 28717, 28742, 28743, 29131, 29133, and 29585.

28609 (AERE-R-4858) A LUMPED CONSTANT DELAY LINE WITH NEGLIGIBLE OVERSHOOT. R. Martin (Atomic Energy Research Establishment, Harwell (England)). Mar. 1965. 34p. Dep.

It is shown how a lumped parameter line may be designed, by the image parameter method, possessing negligible amplitude distortion when driven by a step function. The designed lines (R_0 = 300Ω delay 100 nsec to 2 μsec) had a delay to rise time ratio of five to one and occupied approximately two hundred cubic centimeters. (auth)

28610 (AERE-R-4925) ZONE SELECTION IN ASSOCIATIVE MULTICHANNEL PULSE ANALYSIS. I. N. Hooton, S. A. Hickman, G. M. Prior, and G. C. Best (Atomic Energy Research Establishment, Harwell (England)). May 1965. 8p. Dep.; $0.30(BIS); 1s. 9d. (HMSO).

In the multiparameter analysis of nuclear physics data the hardware required may be greatly reduced by the use of associative storage. If zones within the spectrum are automatically selected for individual channel analysis the associative storage itself may be reduced. The efficiency of such a system is examined and a method of achieving it is outlined. (auth)

28611 (IS-1152) LOW-NOISE NARROW-BAND AMPLIFICATION WITH FIELD EFFECT TRANSITORS. Louis Mourland, Jr., and Wayne A. Rhinehart (Ames Lab., Iowa State Univ. of Science and Tech.). Feb. 1965. Contract W-7405-eng-82. 58p. Dep.; $3.00(cy), 1(mn) CFSTI.

The problem of detecting the presence of signal levels which approach the noise levels in available amplifying devices is considered. The factors which limit amplifier sensitivity are described, and improvements which can be made in circuit design to maximize sensitivity are explained. Low noise, narrow-band amplifier design, relative to the field effect transitor, is discussed and illustrated with a design example. (auth)

28612 (FTD-TT-64-1104) NUCLEAR MAGNETOMETER. W. Zbieranowski and J. Sass. Translated from Przeglad Elektron., No. 2, 74-82(1964). 13p. CFSTI.

General principles and conditions are given for measuring a magnetic field with the aid of a nuclear magnetometer. Individual elements of the system are discussed, and the accuracy of measurements is analyzed. (auth)

28613 MEASUREMENT OF PRESSURE FOR LIQUIDS AND LIQUID METALS AT HIGH TEMPERATURES. B. Schelten-Peterssen and W. Schulze (EURATOM, Ispra, Italy). Arch. Tech. Messen, Lf. 345, 229-30(Oct. 1964). (ERU 2268.d) (In German)

As the normal methods of measuring pressure, that are used for water, oil and gases, can not be applied to liquid metals, special techniques were developed for this purpose. Known methods and measuring equipments as well as a new development are described. The pressure of liquid metals is measured by the following systems: (1) an inert gas atmosphere by means of a manometer. (2) Pneumatic or hydraulic transmission through bellows or diaphragms, hereby compressing another liquid, thus rendering possible a manometer indication. (3) Measuring of the change of position of the bellows due to the liquid pressure by means of a differential transformer. In these methods errors may arise from deposits of oxide as well as from change of spring constants at higher temperatures and change of length due to temperature. In the instrument described, these sources of errors have been avoided, as far as possible. The zero mark remains constant at all ranges of temperature and pressure and can be controlled in operation. (auth)

28614 EXPERIMENTAL EFFECTUATION OF A NEW COUNTING CIRCUIT ACCORDING TO KROEBEL FOR MEASURING DISTRIBUTION FUNCTIONS. W. Boehm (Institut fur Angewandte Physik, Kiel). Atomkernenergie, 10: 107-14(Mar.-Apr. 1965). (In German)

A counting arrangement proposed by Kroebel for recording distribution functions and its realization in an experimental installation are discussed. In this circuit two separate frequency divider channels were used with high division rates and triggered by a h-f standard frequency generator. Channel 1 is fed direct, channel 2 over a gate circuit. Because, within a preselected recording time, a number of standard frequency pulses corresponding to the rate of registering pulses is blanked out in the gate circuit, the output pulses of the two divider channels are displaced from one another in time. This time difference Δt is indicated on an indicator frame on the screen of a cathode ray tube and registered with a continuous recording camera. With the experimental installation the duration of measurement was for a single value 2.048 msec, and it was thus possible within about 0.5 sec to register 250 single values. (auth)

28615 PULSE HEIGHT ANALYZER WITH INTERNAL STORAGE FOR SPACE USE. R. M. Rodrigues (Univ. of California, Livermore). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 66-82(Feb. 1965). (UCRL-7906-T)

A pulse-height analyzer was designed for space use which is able to handle input count rates in excess of 5×10^4 counts per second with low power consumption and very small size. It can operate in the temperature range of −15 to +70°C and survive storage temperature from −55 to +125°C. A parallel-serial, coincident current, wide-temperature-range, ferrite core memory of 256 channels, 16 bits per channel is provided. A digitizing rate of 0.5 μsec per channel plus an average 25.5 μsec storage time is used. An internal, nonoverloading linear amplifier is provided to handle up to 100-mv negative pulses for full scale storage. Control logic is provided for external commands for power, accumulate, nondestructive readout, and destructive readout functions. All input-output logic levels are compatible with conventional integrated circuits. All components are run at a fraction of their ratings in order to obtain maximum reliability. (auth)

28616 RADIATION TOLERANT STARTUP CONTROLLER FOR SNAP 10A. Richard H. Wagner (Bendix Corp., Southfield, Mich.). IEEE (Inst. of Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 126-32(Feb. 1965).

A transistorized startup controller for the SNAP-10A reactor was designed to survive one year in orbit while accumulating a radiation dose of 1×10^{13} nvt fast neutrons and 2×10^7 R gamma radiation. Weibull statistical analysis and plotting techniques were used to predict the effect of radiation on component failure rates. The resultant controller implements startup and control functions with transistor-diode NOR logic. (D.C.W.)

28617 GENERATION AND MEASUREMENT OF UV PULSES IN THE SUB-NANOSECOND REGION. J. T. D'Alessio and P. K. Ludwig (Univ. of Notre Dame, Ind.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 351-5(Feb. 1965).

A pulsed lamp using hydrogen under high pressure is described, with which light pulses with rise and decay times of 0.4 and 0.5 nsec, respectively, and a half-width of 0.4 nsec have been obtained using only the stray capacitance of the lamp. A deflection amplifier designed for use with the lamp is also described. (D.C.W.)

28618 DESIGN TECHNIQUE FOR HIGH SPEED PULSE CIRCUITRY FOR SURFACE MASS SPECTROMETER. Fred H. Sawada (General Electric Co., Schenectady, N. Y.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 374-8(Feb. 1965).

A high-speed amplifier/discriminator was designed and built for use with an electron multiplier as part of a surface-ionization mass spectrometer. This amplifier/discriminator permits low-loss system operation up to 2×10^6 cps average count rate with random pulses. The design technique uses clipping, differentiation, and staggered quiescent operating points to achieve wide dynamic range and high equivalent frequency response. R-f stripline techniques and partial neutralization provide excellent stability over the required bandwidth. Pulse-height discrimination is accomplished through use of a monostable tunnel diode circuit. (auth)

28619 A STUDY OF THE RESOLUTION AND COUNTING RATE OF THE COMPTON GAMMA-MONOCHROMATOR. A. M. Kistner, M. S. Zucker, and H. Lichtenstein (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 8: 59(May 1965).

28620 SUMMARY OF EXPERIENCE WITH HIGH-TEMPERATURE THERMOCOUPLES USED IN THE ORNL-GCR PROGRAM FUEL-IRRADIATION EXPERIMENTS. F. R. McQuilkin, N. H. Briggs, and E. L. Long, Jr. (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 69-70(May 1965).

28621 A THERMAL-NEUTRON TELEVISION SYSTEM FOR POSTIRRADIATION ANNEALING STUDIES. Harold Berger and W. N. Beck (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 73-4(May 1965).

28622 NEW ION COUNTER OF MAXIMUM SENSITIVITY AND INFINITE LIFETIME AS AID IN HIGH-VACUUM MEASURING TECHNIQUES. F. Kirchner (Universitat, Cologne). Vakuum-Tech., 14: 73-5(Apr. 1965). (In German)

A double-focusing mass spectrometer, previously developed for use as a leak detector and for measuring partial pressure was improved. In the counter for registering ions, vapor from the diffusion pump was used instead of iodine vapor. The sensitivity was increased since the zero effect could be forced down. This high sensitivity was preserved even after highest load. The durability of the counter was nearly unlimited. The capability of the instrument for registering single ions was independent of mass, atomic number, energy and chemical composition of the arriving particles in the energy range from 2 to 3 kev. (auth)

28623 PRESSURE GAUGE. Francis Henry Grover, George Frederick Harwood, and Andrew Clark Purdie (to United Kingdom Atomic Energy Authority). British Patent 984,758. Mar. 3, 1965. Filed Mar. 21, 1961.

An instrument for measuring surges in gas pressure such as those caused in the atmosphere by explosion of an atomic weapon is simple and can be left unattended for long periods. It includes a rigid vessel with a large aperture, a small aperture, and a bellows mounted inside. The large aperture admits a pressure surge into the vessel. The small aperture vents the pressure rise caused by the contraction of the bellows. A mechanical recorder indicates and records the extent of the contraction of the bellows. The indicator is a pointer whose movement is friction damped. (A.G.W.)

28624 GAS DENSITY MEASURING APPARATUS USEFUL AS ALTIMETER. James Montgomery McKenzie (to North American Philips Co., Inc.). U. S. Patent 3,173,004. Mar. 9, 1965. Filed July 17, 1961.

The gas density measuring apparatus described consists of a source of heavy charged particles for injecting particles into a sample of the gas whose density is to be measured, a semiconductor radiation detector positioned to receive and detect the particles after passage through the gas sample and to generate a signal representative of the energy attenuation of the particles, and means for utilizing the signal to determine the density of the gas. The preferred particles are α particles from Am^{241}. The device is applicable in a gas density range of about 1.0 to 0.1 mg/cm^2, which corresponds to an altitude of 6000 to 60000 ft. (A.G.W.)

Radiation Detection

Refer also to abstracts 28152, 28420, 28732, 28962, 29016, and 29255.

28625 (AROD-3816.1) DEVICES FOR DETECTING AND TRACING THE PATHS OF IONIZING PARTICLES. Arthur L. Hughes (Washington Univ., St. Louis. Dept. of Physics). Jan. 31, 1965. Contract DA-ARO-(D)-31-124-G427. 8p.

Experiments were initiated on spark chambers in which tracks were produced by alpha particles. Alpha particles produce roughly 40,000 ion pairs per cm under conditions where the particles usually studied in spark chambers produced only 10 to 30 ion pairs per cm. It was thought that this large difference could be used to throw light on the nature of the processes operating in spark chambers. Sparks following oblique alpha particle tracks making angles up to as much as 60° with the normal to the electrodes were observed, mixed up with the much more frequently obtained sparks along the normal to the electrodes. The conditions controlling the direction of the spark led to an extensive study of methods of applying and shaping the high voltage pulse applied to the spark chamber. (auth)

28626 (COO-712-88) A TAPE-TO-PLOTTER CONVERTER. R. A. Semmler and J. F. Tribby (Chicago Univ., Ill. Labs. for Applied Sciences). Sept. 1964. Contract AT(11-1)-712. 52p. Dep.; $3.00(cy), 2(mn) CFSTI.

A tape-to-plotter converter for use with punched paper tapes prepared by a Nuclear Data Model 130A multichannel analyzer is described. The converter reads 3 BCD digits from the tape and generates both linear and logarithmic analogue voltages for plotting. Relays are used for the 12 bit memory and a stepping switch is used to accomplish much of the pulse routing and logic. Circuit diagrams are included. (auth)

28627 (EUR-1815.e(Rev.)(p.235-40)) NOTE ON THE EVALUATION OF NEUTRON FLUX DISTRIBUTIONS. Francesco Girardi and Jules Pauly (European Atomic Energy Community. European Scientific Data Processing Center, Ispra, Italy).

The $^{16}O(n,p)^{16}N$ reaction was used for neutron flux determinations. To obtain the necessary accuracy in the value of neutron flux, absolute induced activity, and thus neutron flux, was measured in irradiation of Cu and Al foils, producing ^{62}Cu, ^{64}Cu, ^{24}Na, and ^{27}Mg. The geometrical distribution of the flux was determined by irradiation of plexiglass of different diameters and thicknesses and measuring ^{16}N activity. The optimum choice of target holder is described. (M.J.T.)

28628 (EUR-1815.e(Rev.)(p.246-53)) 14-Mev NEUTRON FLUX MEASUREMENT WITH A STILBENE SCINTILLATOR. M. Bormann, B. Brennemann, and D. Stuewer (Hamburg. Universität. I. Institut für Experimentalphysik).

The method of fast-neutron flux measurement using n-p scattering in organic scintillators was investigated for 14.1-Mev neutrons with a 1 × 1 inch stilbene crystal. Effects of gamma radiation were excluded by applying pulse shape discrimination. The recoil proton spectra were analyzed by the integral-bias method. Corrections for edge effects and multiple n-p scattering were applied. The error in the flux measurement was estimated to be about 4%. Flux measurements made simultaneously with the stilbene scintillator, with a $^6LiI(Eu)$ scintillator, and by means of the associated particle technique agree within about 2%. (auth)

28629 (INR-583/II/PL) SIMPLE CRYOSTAT FOR COOLING OF NUCLEAR RADIATION SEMICONDUCTOR DETECTORS. W. Przyborski (Institute of Nuclear Research, Warsaw (Poland)). Dec. 1964. 8p. Dep.

The design of a simple cryostat for nuclear radiation semiconductor detectors applications at low temperatures is described. In this cryostat, a sample temperature of about 90°K can be achieved, using ¼ liter of liquid nitrogen only, and 1 liter suffices to maintain this temperature for 5 to 7 hours. The appropriate cooling time is 20 min, and 5 to 7 min is required to warm up the previously cooled sample to the room temperature. (auth)

28630 (JINR-P-1937) POSLEDOVATEL'NOE PITANIE PROMEZHUTKOV ISKROVOI KAMERY. (Consequent Supply Into Spark Chamber Gaps). B. N. Gus'kov, A. T. Matyushin, and V. T. Matyushin (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1965. 11p. Dep.(mn).

Nine duraluminum plates 415 × 410 mm^2 in area and 1 mm thick were mounted in a hermetically sealed plexiglass box filled with neon at 1.02 atm. in order to make a spark chamber. With parallel feed, the parameters of the spark chamber are as follows: 1) a calculated gap capacity of 125 pF, 2) 8 spark gaps, 3) total chamber capacity of 125 nF, 4) a total discharge capacity of 4 nF, 5) a high-voltage pulse front of 100 nsec, and 6) a feed voltage of 0 to 30 kv. The breakdown potential is 16 to 18 kv which gradually increases with time. The spark chamber can also be hooked up in a series-parallel arrangement with 4 gaps connected in series to form two groups I and II which are connected in parallel. The chamber parameters with series feed of the gaps is as follows: 1) a calculated capacity of 4 series-connected gaps (one group of 31 pF, 2) a chamber capacity of 62 pF for a series-parallel hook-up, 3) a high-voltage pulse front of 30 nsec, and 4) a feed voltage of 0 to 30 kv. The experimental results show that the chamber efficiency with the series hook-up is greater than with the parallel arrangement for the same impressed voltage V_0. The increase in efficiency and its decrease as a function of the pulse lag is steeper with the series hook-up. The spark thickness along the track is smaller and more homogeneous with the series arrangement. The counting of a number of particles or the "multi-track" efficiency should be improved with the series arrangement. (TTT)

28631 (JINR-P-2017) VYSOKOSTABIL'NYI NEPEREGRUZHAYUSHCHISYA LINEINYI USILITEL. (A Highly Stable Nonoverloading Linear Pulse Amplifier). G. Muziol (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1965. 9p. Dep.(mn).

A linear nonoverloading amplifier on valves for β- and γ-spectrometrical applications is described. The gain is controlled between 50 and 12,200 by simultaneously changing the feedback-factor and the open loop gain, so that their product is a constant. The width of the pulses, bipolar formed in the amplifier, is fine-controlled up to 2 μsec. Other performances are: risetime = 0.15 μsec the overloading factor is > 50, the long-time gain stability is for 24h < 1%, the integral linearity is < 0.4% up to pulse heights of 125 v. (auth)

28632 (KFK-263) A VERY FLEXIBLE PULSED BEAM SPECTROMETER FOR STUDYING NEUTRON SCATTERING IN SOLIDS AND LIQUIDS. F. Carvalho, G. Ehret, W. Glaeser, and H. Ripfel (Kernforschungszentrum, Karlsruhe (West Germany). Institut fur Angewandte Kernphysik). Oct. 1964. 14p. Dep.(mn).

The general design and the advantages of the high-speed-rotating-crystal time-of-flight spectrometer are discussed. Methods for monochromating the beam, composed of neutrons reflected at different orders, are outlined. Arrangements for various kinds of measurements are described, including the measurement of double differential scattering cross sections in isotropic materials for a wide range of momentum and energy transfers, the measurement of small momentum transfers with high resolution to study diffusion processes in liquids, the determination of dispersion laws in single crystals, and structure research using the apparatus as a time-of-flight diffractometer. The use of a Control Data 160-A on-line computer for data acquisition and reduction is described. (M.J.T.)

28633 (MIT-2098-51) A LIQUID-NITROGEN-COOLED-ADSORPTION NEON-RECOVERY SYSTEM. B. M. Bailey and A. Buffington (Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science). [June 23, 1964]. Contract AT(30-1)-2098. 5p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

A simple, inexpensive apparatus was assembled to permit recovery of pure Ne gas from a spark chamber at the rate of ~800 l/hr. The Ne is exhausted from the chamber by a small mechanical vacuum pump which delivers the Ne by way of cold trap to a liquid-nitrogen-cooled adsorption vessel at a pressure between 2 and 3 atm. The system results in greatly reduced pure Ne make-up requirements and removes contaminants from Ne before re-use in the chamber. (auth)

28634 (N64-20603) AN INSTRUMENT FOR THE MEASUREMENT OF INTERPLANETARY SOLAR PLASMA. Conrad Josias and James Lawrence, Jr. (Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena). May 1, 1964. Contract NAS 7-100. 69p. (NASA-CR-56038; JPL-TR-32-492). $6.60(CFSTI).

An important scientific result of the interplanetary flight of the Mariner 2 spacecraft to the planet Venus was the collection of extensive detailed data indicating the presence of a constantly flowing solar wind. The Mariner 2 solar plasma instrument and its predecessor, which flew on Rangers 1 and 2 are described. Special emphasis is given to the discussion of a wide-range electrometer system stabilized by a dynamic capacitor. The instrument measures charged-particle energy spectra with a sensor consisting of a pair of concentric curved electrostatic deflection plates terminated by an isolated Faraday collector cup. The collection rate of charged particles is measured with an electrometer whose wide dynamic current range is provided by a logarithmic compressor composed of one or two subminiature thermionic diodes operated in the regarded field region. The electrostatic field is controlled by a programmed high-voltage sweep amplifier that provides the deflection plates with voltages of equal magnitude but opposite polarity. A history of preflight testing and calibration of the Mariner 2 flight instrument, in addition to some details of its flight performance, is included. (auth)

28635 (NOLTR-64-220) GAMMA-RAY SPECTROMETER DATA PROCESSING PROGRAMS. Susan Madigosky and R. T. Woodham (Naval Ordnance Lab., White Oak, Md.). Feb. 1965. Contract AT(49-7)-2430. 31p. (AD-611198) Dep.(mn); $2.00(cy), 2(mn) CFSTI.

Two computer programs were written to analyze and display (plot) the spectral output of two different gamma-ray spectrometers. These spectrometers are the anti-Compton spectrometer currently in use in NOL's Van de Graaff facility and the Deep Underwater Nuclear Counter (DUNC). Both programs have been written for use with an IBM 7090 computer. The program for the anti-Compton spectrometer adds (subtracts) in variable amounts spectra which are stored in one half of a multichannel analyzer to those stored in the other half. It also performs necessary energy or total count normalization, calculates statistical errors, and displays the processed data on linear or semi-logarithmic plots. The DUNC program is used to prepare magnetic tape from a paper punch tape output of a multichannel analyzer. It also searches the magnetic tape for spectra to be normalized, operated upon arithmetically and displayed in printed, punched card or graphic form on the CalComp plotter. (auth)

28636 (NP-14874) STABILITY TESTS AND X-RAY ANALYSIS EXPERIMENTS WITH A 512-CHANNEL PULSE-HEIGHT ANALYSER-COMPUTER AND A LOW-NOISE AMPLIFIER. L. Svansson, M. De Carolis, and W. Sas-Korczynski (European Company for the Chemical Processing of Irradiated Fuels, Mol (Belgium)). Feb. 1964. 37p. (ETR-163). Dep.(mn); $2.00(cy), 1(mn) CFSTI.

Stability tests were made on a nuclear analyzer system

consisting of a 512 pulse height analyzer and two different types of detector: one 2" × 2" Na(Tl)I crystal for gamma detection, and one 100-mm² surface barrier semiconductor with ORTEC pulse-cut amplifier for alpha detection. In particular, the system accuracy for spectrum stripping was investigated. As an example of the stripping possibilities, a proposal is made for determining plutonium in the presence of ^{241}Am by means of detection of the 17.2-kev x-ray energy from ^{239}Pu conversion to ^{235m}U. By utilizing the Ortec pulse-cut amplifier together with the gamma detector it is possible to display any part of the energy range over all the 512 channels. The experiments showed that under certain conditions, i.e., low beta-gamma background and spectra that are not too complicated, the system stability is sufficient to utilize the x-ray analyzing method and spectrum stripping to reduce the composite spectrum into its component parts. (auth)

28637 (ORNL-TM-998) A SENSITIVE TUNNEL-DIODE DISCRIMINATOR. N. W. Hill (Oak Ridge National Lab., Tenn.). Jan. 12, 1965. Contract W-7405-eng-26. 5p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Recently available ultrahigh-speed germanium tunnel diodes with very low junction capacitance make it possible to design highly sensitive discriminators or threshold circuits for use with pulses having rise and fall times of a few nanoseconds. A tunnel diode discriminator module which permits the detection of 2-mv 3-nsec rise time photomultiplier pulses is described. The precautions required with regard to input-output terminations, both within the discriminator circuit and in the circuits which follow it, and with regard to regulation of power supplies against line and load variations are given. (auth)

28638 (ORNL-TM-1055) OPTIMIZATION OF SEMICONDUCTOR PREAMPLIFIERS FOR USE WITH SEMICONDUCTOR RADIATION DETECTORS. Theron Vaughn Blalock (Oak Ridge National Lab., Tenn.). Feb. 23, 1965. Contract [W-7405-eng-26]. 252p. Dep.(mn); $6.00(cy), 4(mn) CFSTI.

The input and filter sections of the nucleonic preamplifier, which determine the noise line width and the pulse shape, are considered. A literature survey of theoretical physical operation and noise characteristics of field-effect transistors is presented. A noise theory based on a power-law doping profile is developed. Design considerations for optimum input-section performance are presented. Expressions for pulse response and noise power spectral density are derived. Pulse geometry and signal-to-noise ratios of various filter sections are considered. Experimental results are presented and correlated with the design theory. (M.J.T.)

28639 (TID-21830) PRECISION MEASUREMENTS OF GAMMA-RAY ENERGIES UP TO 2 Mev USING A 2-METER CURVED-CRYSTAL MONOCHROMATOR. J. J. Reidy and M. L. Wiedenbeck (Michigan Univ., Ann Arbor. Dept. of Physics). [1965]. Contract [AT-(11-1)-1112]. 37p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

Precision measurements of gamma-ray energies up to 2 Mev were performed using the U–M 2m curved-crystal monochromator. Effective source activities of less than 40 mC were used for the measurements of the transitions in the 2-Mev region. In the 150-kev region, effective source activities of less than 200 C may be used. Measurements have been performed on the transitions of energies less than 2150 kev which follow the decay of ^{116}In (54 min), ^{56}Mn (2.6 h) and ^{46}Sc (85 d). In addition, results are presented which indicate that the reflection coefficient is approximately linear with respect to wavelength for the second order reflection from the germanium $(0\bar{2}2)$ planes in the region of 6-90 mÅ (2000-135 kev). (auth)

28640 (UCRL-7799) DEMONSTRATION MODEL OF THE CAUCHOIS SPECTROMETER. B. G. Saunders (Lawrence Radiation Lab., Univ. of California, Livermore). Mar. 31, 1964. Contract W-7405-eng-48. 9p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

The Cauchois bent-crystal gamma spectrometer measures photon energies from thermal-neutron capture in various materials; the photon beam is collimated, diffracted by the crystal, and detected by a nuclear emulsion. A description is given of the design, construction, and educational use of a model of the spectrometer using light rays. (M.J.T.)

28641 A METHOD FOR THE ABSOLUTE MEASUREMENT OF FAST NEUTRON FLUX WITH A LARGE LIQUID SCINTILLATOR. H. Conde, S. Schwarz, and N. Starfelt (Research Inst. of National Defence, Stockholm). Arkiv Fysik, 29: 45-52(1965).

A method of making an absolute measurement of the flux of fast neutrons was studied. An accurately determined fraction of the neutrons in a collimated beam passing along a channel through a large liquid scintillator is scattered into the scintillator. An absolute measurement of the ^{6}Li(n,α)T cross section is made by placing a ^{6}Li-glass scintillator in the calibrated neutron beam. (auth)

28642 FISSION NEUTRON SPECTRA. PART I. A NEUTRON DETECTOR FOR FAST NEUTRON TIME-OF-FLIGHT SPECTROSCOPY. H. Conde, G. During, and J. Hansen (Research Inst. of National Defence, Stockholm). Arkiv Fysik, 29: 307-12(1965).

A low threshold neutron detector to be used in nanosecond time-of-flight spectroscopy was constructed. The detector construction is described, and the result of a measurement of the detector efficiency to neutrons of energies between 70 kev and 6 Mev is given. The time resolution of a time-of-flight equipment using the neutron detector is discussed. (auth)

28643 COSMIC RAY MESON MONITORS WITH PLASTIC SCINTILLATORS. Arne Eld Sandstroem, Eric Dyring, Lars Ekstroem, and Bo Oestman. Arkiv Fysik, 29: 329-41(1965).

Meson monitors with plastic scintillators as detectors and a nearly cubical geometry were designed for a total counting rate (four channel of the order of 10^6 c/hr. The eight detectors also serve four two-channel inclined telescopes (nominal zenith angle 45°) with counting rates of the order of 1.6×10^6 c/hr. The channels are designed for two-fold coincidences. All electronic circuits are fully transistorized with exception of the high-voltage sets. No filters are used. The number of counts for each channel are printed once every hour. Parallel recording circuits permit the printing of 5-min values, one printing recorder serving each one of the five directions. Characteristics of the particle detectors and channels are described by diagrams. Samples of intensity-time variations demonstrate that the capacity of the monitors fulfill all expectations. (auth)

28644 DETERMINATION OF THE DOSE OF FAST NEUTRONS BY THRESHOLD DETECTORS WITH IRRADIATION EXPERIMENTS IN A REACTOR CORE. L. Greim (Gesellschaft fur Kernenergieverwertung in Schiffbau und Schiffahrt, mbH., Geesthacht, Ger.). Atomkernenergie, 10: 87-92(Mar.-Apr. 1965). (In German).

A method is described for calculation, from the activation of an integrating threshold detector, of the dose of fast neutrons, which a sample irradiated at the same time and at the same place, receives in a reactor core. It was assumed that the energy is transferred only by elastic collisions of the neutrons with the nuclei. The way in which the relation between induced radioactivity of the threshold detector and absorbed dose depends on great variations of the neutron spectrum is shown with nickel as threshold detector and a probe, which contains mainly hydrogen. This showed to what proportion the accuracy of the method is influenced by the effective threshold energy of the detector and by the value $E\sigma(E)$, representative for energy transfer as function of neutron energy, and by the form of the neutron spectrum. Coarse assumptions about possible neutron spectra were made for the calculated example to obtain the factor of proportionality between activity of the detector and dose absorbed by the sample. The systematic deviations are discussed. (auth)

28645 THE SATURATION CHARACTERISTICS OF A GRENZ-RAY IONIZATION CHAMBER. T. E. Burlin (St. Johns Hospital, London) and S. R. Husain. Brit. J. Radiol., 38: 386-9(May 1965).

The saturation characteristics of the Victoreen grenz-ray chamber were measured and the average collection efficiency determined when the chamber is used to measure exposure. If the instrument is used to measure exposure rates below 1800 R/minute the recombination losses will not exceed 7 per cent. (auth)

28646 WIRE SCANNER AND THE AUTOMATION OF THE DECAY CORRECTION. Setsuo Kobayashi (Hitachi, Ltd., Tokyo). Genshiryoku Kogyo, 10: No. 8, 51-6(Aug. 1964). (In Japanese)

In the conventional method of determination of the neutron flux distribution in a reactor etc., foils are placed at different places in the reactor for irradiation and the induced radioactivities are measured. A wire scanner was designed and constructed in which a metallic wire instead of foils was used. The wire scanner developed has a radioactivity detection head of a windowless gas-flow counter type; through this head the wire is inserted and fixed under tension by the supports, which are on a base. In the measurement, the head mounted on the base is moved intermittently along the wire. The decay of the samples during the intervals is corrected automatically in the wire scanner. The windowless gas-flow counter mechanism has the following advantages in the measurement: (1) measurement of weak β rays, (2) high detection efficiency (close to 4π), and (3) excellent stability for long measurements. (NSA of Japan)

28647 ON THE AUTOMATIC MONITORING AND CLASSIFING APPARATUS OF LOW RADIOACTIVE LIQUIDS. REPORT 2. Keiji Miyazaki and Setsuo Kawamoto (Hitachi Shipbuilding and Engineering Co. Ltd., Tokyo). Hitachi Zosen Giho, 25: No. 4, 19-23(Nov. 1964). (In Japanese)

In the preceding report, a new apparatus for automatic monitoring and classifing of low level radioactive liquids was investigated. In this report, radioactive contamination of the detecting part is investigated with respect to kinds of material of the detecting parts and chemical characteristics of radioactive liquids. Suitable conditions for such an apparatus are suggested. (auth)

28648 11TH NUCLEAR SCIENCE SYMPOSIUM, INSTRUMENTATION IN SPACE AND LABORATORY, PHILADELPHIA, PA., OCTOBER 28-30, 1964. IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 1-483(Feb. 1965). New York, The Institute of Electrical and Electronics Engineers, Inc., 1965. (CONF-799)

Separate abstracts were prepared for 54 of the 64 papers included. Five other papers on the ionosphere, the interplanetary plasma, cosmic radiation in space, coronal expansion, and x-ray astronomy were included only as abstracts. The ten remaining papers were previously abstracted for NSA, 19: 2600, 2604, 4432, 4774, 4775, 6182, 9488, 9493, 9494, and 24548. (D.C.W.)

For abstracts of individual papers see: 28472, 28527, 28528, 28529, 28530, 28531, 28533, 28615, 28616, 28617, 28618, 28649, 28650, 28651, 28652, 28653, 28654, 28655, 28656, 28657, 28658, 28659, 28660, 28661, 28662, 28663, 28664, 28665, 28666, 28667, 28668, 28669, 28670, 28671, 28672, 28673, 28674, 28698, 28699, 28700, 28701, 28702, 28881, 28986, 28987, 29185, 29186, 29476, 29477, 29652, 29752, 29753, 29754, and 29755.

28649 BACKGROUND IN LIQUID SCINTILLATION COUNTING SYSTEMS. C. F. G. Delaney and A. J. McGovern (Univ. of Dublin). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 13-15(Feb. 1965).

Estimates are given, for a particular radiocarbon dating system, of two possible sources of residual background occurring in coincident liquid scintillation arrangements—the natural radioactivity of the phototubes and optical feedback between them. The former was found to contribute about 1.8 cpm or 13% of the background, but there was no evidence of any significant contribution from the latter. (auth)

28650 GAIN VS TEMPERATURE EFFECTS IN NaI(Tl) PHOTOMULTIPLIER SCINTILLATION DETECTORS USING 10 AND 14 STAGE TUBES. R. Erline Rohde (Argonne National Lab., Ill.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 16-23(Feb. 1965).

The manner in which the gain of a radiation transducer comprised of a 2" × 2" NaI(Tl) crystal, and either a 5-inch 10-stage or 2-inch 14-stage photomultiplier tube viewing a ^{137}Cs source, varies with ambient temperature changes over the range of 0 to 50°C was investigated. Gain vs temperature response curves are presented and operating temperatures which minimize gain variations are delineated. A method is given for evaluating the magnitude of gain variations encountered from the curves. (auth)

28651 EVALUATION OF ORGANOMETALLIC COMPOUNDS FOR GAMMA DETECTION IN PLASTIC SCINTILLATORS. K. C. Tsou (Univ. of Pennsylvania, Philadelphia). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 28-33(Feb. 1965).

A series of copolymers of vinyl toluene containing various organometallic compounds were recently synthesized. By taking advantage of the weak fluorescent characteristics of the organometallic compounds and the better understanding of the energy transfer and quenching process, it is possible to prepare organometallic scintillation plastics that may be useful for gamma detection. A 20% triphenyltinstyrene and vinyl toluene copolymer containing 3% PBD and 0.05% POPOP were evaluated at the Health and Safety Laboratory, New York Operations Office. The sample size was only $1\frac{5}{8}$" by 1" thick cylinder. In general, the pulse height is 45 to 50% of that observed from anthracene, and the cross section is still less than that observed for sodium iodide. However, the photopeaks are definitely resolvable when evaluated for ^{203}Hg, ^{109}Cd, and ^{137}Cs. In the last case, the energy resolution for 662-Mev photons lies between 16 and 19%. (auth)

28652 LOW ENERGY CHARGED PARTICLE DETECTION USING THE CONTINUOUS CHANNEL ELECTRON MULTIPLIER. D. S. Evans (Goddard Space Flight Center, Greenbelt, Md.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 34-8(Feb. 1965).

It was found to be possible to operate the continuous channel electron multiplier, a recently developed type of windowless electron multiplier, in a gain saturated mode such that single charged particles entering the input mouth of the channel will initiate output pulses whose amplitude and shape are both uniform and independent of the character of the excitation radiation. By suitable design of the channel this saturated pulse can be made stable against changes in such operating conditions as ambient pressure and applied voltage. Some degradation in the pulse height distribution is noted at very high count rates of at least 10^5 per second is possible. When operated in this mode the efficiency of the channel for the detection of electrons over the energy range 250 ev to 10 kev is estimated to be greater than 50%. The channel multiplier was used as the detector in rocket-borne low-energy electron spectrometers to obtain the energy spectrum of the auroral electrons. Data indicate that the operation of the detectors was as expected. (auth)

28653 EVALUATION OF NEW PHOTOMULTIPLIERS FOR SCINTILLATION COUNTING. H. R. Krall (Radio Corp. of America, Lancaster, Penna.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 39-45(Feb. 1965).

A comprehensive evaluation of a new bi-alkali-photocathode photomultiplier developed specifically for scintillation counting is presented. This recently developed photomultiplier is compared to existing photomultiplier types, and data are presented showing the photocathode quantum efficiency as a function of wavelength, pulse-height resolution for ^{137}Cs and ^{55}Fe, dark-noise spectra

at 25 and −100°C, anode rise time and pulse shape, and pulse-height stability with respect to time and count rate. A method is described for measuring the spatial uniformity of photomultipliers, using a dot-pattern-scanned cathode-ray-tube light source, a pulse-height analyzer, and a live cathode-ray-tube display. (auth)

28654 LOW POWER FAST PULSE CIRCUIT TECHNIQUES IN THE MIT GAMMA-RAY TELESCOPE. F. Williams Sarles, Jr. (Massachusetts Inst. of Tech., Lexington) and James K. Roberge. IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 46-53(Feb. 1965).

In the electronics instrumentation of the gamma telescope, the analog portion of the electronics, which must respond to input pulses as short as 3 nsec and which contains about 430 transistors, operates with a power requirement of 350 mw. The entire electronics package of 8000 components (1300 transistors) has a total power consumption of only 500 mw. The salient points in the design and operation of the gamma telescope, are described, and the signal processing involved in the analog section of the instrument and some design problems peculiar to the conflicting requirements of high-speed input pulses and low-power circuits are discussed. (auth)

28655 X-RAY TELESCOPE FOR AN ORBITING SOLAR OBSERVATORY. D. B. Hicks (Ball Brothers Research Corp., Boulder, Colo.), L. Ried, Jr., and L. E. Peterson. IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 54-65(Feb. 1965).

An x-ray experiment designed to monitor the intensity, energy distribution, and time variations of solar x rays and to measure the intensity and angular distribution of x rays over the celestial sphere is described. The detector, which operates between about 7 to 200 kev, will also monitor local effects due to cosmic rays, trapped particles, and albedo gamma rays. The telescope consisted of a thin NaI(Tl) crystal-phototube assembly surrounded by a 10.5-lb cylindrical cup-shaped CsI(Tl) shield crystal. The shield, connected in anticoincidence, had a 2-cm wall and defined a field of view of 13 degrees half-angle for the NaI detector. The detector had an area of 9.3 cm^2 and a geometry factor of 1.5 sterad-cm^2. The charge-energy relationship was divided into eight logarithmically spaced pulse-height channels. Integral rates of the shield crystal were monitored for two thresholds, set at 85 kev and 3.2 Mev, respectively. Binary and logic circuits provided scaling, storage, and directional information for each channel, and conditioned the data for transmission through the spacecraft telemetry. The experiment is to be flown on the NASA S-57 Orbiting Solar Observatory-C, scheduled for launch in early 1965. The observatory is to be placed in a near circular orbit at 300 nautical miles at an inclination of 33 degrees to the equator. The design lifetime of the instrument is six months. Performance checks with ground observations and with high-altitude balloons indicated the counting rate due to phototube noise to be 3 counts per minute for events >7 kev. The background, due to cosmic ray effects, was on the order of 10^{-2} photons/cm^2-sec in the 50 to 100 kev range at a magnetic latitude of 40 deg. (auth)

28656 MULTICHANNEL SPECTROMETER FOR THE MEASUREMENT OF TRAPPED PARTICLES. J. B. Reagan, J. C. Bakke, W. L. Imhof, and R. V. Smith (Lockheed Missiles and Space Co., Palo Alto, Calif.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 83-8 (Feb. 1965).

Two versions of a spectrometer designed to measure the energy spectrum and omnidirectional flux of high-energy charged particles in low-altitude satellite orbits are described. (D.C.W.)

28657 UTILIZATION OF WEB SILICON FOR POSITION-SENSITIVE DETECTORS. E. J. Ludwig (Rutgers Univ., New Brunswick, N. J.), W. B. Gibson, and J. S. Hood. IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 247-54(Feb. 1965).

Position-sensitive, surface-barrier detectors were made with web silicon, a hyper-pure silicon in ribbon form. Several characteristics of this material are especially suited for position detectors, long lengths, flexibility and high surface lifetimes. In addition, the structural stability, thickness uniformity, and thin cross sections make this material attractive for standard or position-sensitive dE/dx detectors. Counters with active areas of 2-3.5 cm × 2-4 mm were tested with 5.5-Mev alpha particles yielding spectra sensitive in position to less than 1%. A region of twin planes is exhibited within the material by changes in the slope of the plots of detector capacitance and leakage current as functions of reverse bias. The effect of the twin planes on the carrier collection efficiency was investigated with several samples and found to be significant in certain cases. These results are discussed in terms of carrier lifetimes. (auth)

28658 LARGE GERMANIUM LITHIUM-DRIFT p-i-n DIODES FOR GAMMA-RAY SPECTROSCOPY. A. J. Tavendale (Atomic Energy of Canada Ltd., Chalk River, Ont.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 255-64(Feb. 1965).

Lithium-drifted germanium p-i-n diodes with depletion depths up to 11 mm and an active volume 6 cm^3 were fabricated from 10 ohm-cm, gallium-doped material using a high-power drift method. The diodes were immersed in chloroform and drifted at ohmic dissipation power levels in the range 50 to 100 w at 30 to 50 v d-c drift bias. Diodes were electrothermally stabilized during drift by the boiling action of the chloroform. Peak power levels of up to 250 w at 200 v bias were obtained at the commencement of the chloroform drift, but were reduced to within the range given above following a rapid increase in leakage current during the first few hours of drift. Diode temperatures were estimated at 10 to 20°C above the chloroform boiling point. Drift times were typically 500 to 700 hr for depletion depths of 8 and 10 mm respectively. Seven diodes with depletion depths of 6 to 11 mm were operated as gamma spectrometers in vacuum (10^{-6} mm Hg) at liquid N_2 temperatures (77°K) with bias up to 1200 v and leakage currents ~10^{-9} amp. Some typical spectral response characteristics are given for diodes used as photoelectric gamma spectrometers, and the effect of carrier trapping on energy resolution is demonstrated. Resolutions of 3.5 and 8.0 kev on the full-energy peaks of 122- and 1333-kev gamma rays were obtained from a device of average performance (5 cm^2 × 7 mm depletion depth). The intrinsic full-energy peak efficiency of a 4.0-cm^3 diode was measured at 1% at 1000-kev gamma energy. A diode of "open-ended" coaxial construction, partially drifted to an active volume of 16.5 cm^3, was tested as a gamma detector. The advantages of this structure are discussed. (auth)

28659 A LITHIUM DRIFTED GERMANIUM SURFACE BARRIER DETECTOR. H. DeLyser (Solid State Radiations, Inc., Los Angeles), F. P. Ziemba, and W. R. Van Antwerp. IEEE((Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 265-74(Feb. 1965).

The fabrication procedure and some properties of thin-window lithium-compensated germanium nuclear-particle detectors are described. Their response to various nuclear particles is illustrated with typical spectra. In addition, some data on collection times in germanium and silicon detectors are presented, along with a description of experiments concerning the relative energies to form an electron-hole pair in silicon and germanium at liquid-nitrogen temperature. Finally, the relative response of germanium and silicon detectors to fast neutrons is compared. (auth)

28660 INTERNAL PULSE AMPLIFICATION IN HIGH FIELD, SILICON RADIATION DETECTION JUNCTIONS. Gerald C. Huth, James B. Trice, James A. Shannon, and Russell A. McKinney (General Electric Co., Valley Forge, Penna.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 275-80(Feb. 1965).

Significant internal pulse amplification was observed in silicon p-n junction radiation detectors operated in the

very high field (but prebreakdown) region. Such internal electric field values (peak fields of 60 to 250 kv cm^{-1}) are attainable over distances of up to 250 μ through the use of geometrical control of the field existing at the surface of the junction. Amplification factor for the simple P + N geometry studied thus far is not constant being greatest for the short range particles and decreasing as particle range into the detector increases. In the amplifying mode, a directional effect is observed with amplification being dependent upon energy loss in the region of highest field (and thus the direction of the particle). Detector response was measured for incident alpha particles, beta particles in the energy range from 0.04 Mev to minimum ionizing, protons from 0.5 to 3.0 Mev, and for 5-kev x rays. Pulse risetimes which should be in the sub-nsec range for these geometries were measured with alpha particles and with synchronous 0.88- and 1.06-μ wavelength photons from pulsed lasers with the detector being able to follow laser pulses with 2 to 5-nsec risetime. It is believed that the magnitude of internal amplification makes feasible the use of tunnel diodes in associated circuitry for numerous applications. Preliminary results to this end are briefly discussed. (auth)

28661 USE OF THE $Si^{A}(n,\alpha)Mg^{A-3}$ AND $Si^{A}(n,p)Al^{A-1}$ REACTIONS IN A SEMICONDUCTOR DIODE FOR MEASURING NEUTRON SPECTRA. James A. Shannon, James B. Trice, and Gerald C. Huth (General Electric Co., Valley Forge, Penna.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 281-3(Feb. 1965).

A method of calculating neutron spectra in the energy range above 3 Mev is presented. Analysis of the pulse height due to the (n,p) and (n,α) interaction in a silicon charged-particle detector permits computation of the neutron spectrum by inversion of a matrix, the elements of which are proportional to the charged-particle cross section. (auth)

28662 NEW RESULTS ON THE RECTIFYING PROCESS IN SURFACE BARRIER COUNTERS. P. Siffert and A. Coche (Centre de Recherches Nucleaires, Strasbourg). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 284-7(Feb. 1965).

In order to understand the rectifying process involved in silicon surface-barrier particle counters, the usual gold contact was substituted with various metals. The results obtained from this substitution with twenty different metals are given. Results concerning the formation of the rectifying process for the case of gold-silicon diodes are presented. In particular, the resistivity of silicon and the thickness of the gold film were considered. (auth)

28663 PREPARATION, CHARACTERISTICS, AND APPLICATIONS OF HIGH-VOLTAGE SILICON SURFACE-BARRIER DETECTORS. Ernest D. Klema (Northwestern Univ., Evanston, Ill.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 288-90(Feb. 1965).

Surface-barrier detectors were fabricated from high-resistivity (up to 20,000 ohm-cm) n-type silicon by a technique which allows them to be operated at large reverse-bias voltages without guard rings. Protons of 17-Mev energy obtained from (d,p) reactions at the Argonne National Laboratory Tandem Van de Graaff accelerator were stopped with a reverse bias of 700 v on a detector made of 20,000 ohm-cm material. The detector area is 28 mm^2, and it was cooled by means of a thermoelectric device. Under these conditions, the measured energy resolution is 29 kev for the protons, and the leakage current is 0.1 μamp. This detector operates satisfactorily at reverse biases up to 1800 v. At this voltage, its measured energy resolution for 1-Mev electrons is 35 kev at room temperature, and its leakage current is 1.12 μamp. Special precautions required when the detectors are used at accelerators are discussed. The methods used to form the inversion layers of these detectors and to protect their edges are discussed in some detail since it is necessary that the reverse bias be withstood with both low noise and low leakage current to obtain good energy resolution. The characteristics of some of these detectors were observed for a period of two years, and conditions necessary for their stability with time are given. The detectors were also tested in a vacuum of 2×10^{-6} mm of Hg for a period of several months and were found to be stable under these conditions. Satisfactory techniques were developed and used to fabricate detectors as small as 2 mm and as large as 2.7 cm in diameter. (auth)

28664 INVESTIGATION OF THE ANOMALY IN THE RESPONSE OF SILICON SEMICONDUCTOR RADIATION DETECTORS AT LOW TEMPERATURES. W. R. Dodge, S. R. Domen, A. T. Hirshfeld, and D. D. Hoppes (National Bureau of Standards, Washington, D. C.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 295-303 (Feb. 1965).

Investigation of the response anomaly in silicon semiconductor radiation detectors cooled to temperatures below 40°K was continued. Experiments with surface-barrier detectors show that the mean temperature at which normally ionized impurity atoms accept electrons (as deduced from dE/dx measurement of the depletion depth) is a slowly varying function of the impurity concentration. This behavior is expected from the dependence of the Fermi level on the temperature, impurity concentration and ionization energy. Below the narrow temperature interval in which the majority of the impurity atoms accept electrons and hence become electrically neutral, particles which produce low ionization densities (beta particles) produce pulse heights with room temperature magnitudes, while particles with high ionization densities (alpha particles) produce pulse heights which are lower than those characteristic of room temperature operation and which depend on the detector bias voltage. The results of experiments conducted to investigate polarization effects in lithium-drifted semiconductor radiation detectors are described. (auth)

28665 CYCLOTRON TESTS TO DETERMINE THE RESPONSE OF SOLID-STATE DETECTORS TO PROTONS OF ENERGIES 50 TO 160 Mev FOR USE IN A PROTON SPECTROMETER. Gary W. Grew (Langley Research Center, Hampton, Va.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 308-13(Feb. 1965).

Tests were conducted at the 160-Mev Harvard cyclotron on fully depleted solid-state detectors. This work was done in conjunction with a feasibility study of a proposed proton spectrometer consisting of two dE/dx detectors in a coincident telescope arrangement that can analyze protons over an energy range from 0.5 Mev to greater than 200 Mev. The surface barrier sensors were exposed to protons of energies varying from 50 to 160 Mev to determine the response of these sensors to high-energy protons. The two major parameters to be determined were the most probable energy loss in the detector by protons of energy E and the resolution of the energy-loss distribution. The results of the tests are compared with the Symon treatment of the Landau effect. The proposed proton spectrometer is also discussed briefly. (auth)

28666 HIGH STABILITY NUCLEAR PULSE AMPLIFIER ANALYSIS. Kenneth F. Hatch (Univ. of California, Livermore). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 314-24(Feb. 1965). (UCRL-7947-T; UCRL-7947(Rev.I))

Design equations are derived for the transistor current feedback amplifier that are necessary for careful gain stability analyses. The expressions clearly define the open loop gain limitations and indicate circuit variations which greatly improve the temperature stability. The parameter rd ($1/h_{oe}$) of the grounded emitter stage is seen to require the greatest attention. It limits open loop gain, but stability of the open loop gain can still be achieved. The design equations are general, and modifications to the basic loop further improve stability, reduce input and output impedances, or enable the use of high impedance input. A four-transistor feedback loop was tested, which has 0.01 ohms input and output impedances, a gain of 50, a rise time of 15 nsec, and a temperature stability of 10 ppm/°C. (auth)

28667 ONE-MICROSECOND ADC USES GATED, 55-MEGACYCLE OSCILLATOR. G. F. Comiskey, R. A. Karlin, and R. D. Carlson (Linear Alpha, Inc., Evanston, Ill.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 325-8(Feb. 1965).

A Wilkinson-type analog-to-digital converter designed to operate in conjunction with a 1-μsec memory is described. The nominal clock rate is 55 Mcps, at which the conversion time for 40 channels is under 0.8 μsec. (D.C.W.)

28668 A FAST ADC FOR PULSE HEIGHT ANALYSIS. T. L. Emmer (Nuclear-Chicago Corp., Oak Ridge, Tenn.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 329-35(Feb. 1965).

A 256-channel analog-to-digital converter (ADC) having a 10 nsec per channel digitizing rate utilizing a 100-Mc crystal-controlled clock is described. Pulse analysis is accomplished by a new technique; a sample of the input pulse is analyzed based on crossover timing rather than peak detection. This technique results in better linearity and less spectrum distortion at high counting rates. The crossover timing also provides a means of pile-up rejection based on the input pulse shape. A flexible address control provides a means of digital zero suppression which eliminates the spectrum distortion normally present with analog zero suppression and provides an accurate, reproducible means of analyzing portions of a spectrum. In order to minimize the ADC dead time, address information is transferred in parallel to the memory. Immediately after transfer the ADC is free to accept another input pulse for analysis. The ADC was designed as a plug-in accessory to a versatile, high-speed, thin-film memory. The complete system provides a means for accurately accumulating data at analyzed counting rates exceeding 100,000 stored counts per second. (auth)

28669 MONITORING OF SILICON DETECTOR SYSTEMS WITH PULSED GaAs. Robert W. Kuckuck (Univ. of California, Livermore) and J. Chong Lee. IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 356-60 (Feb. 1965). (UCRL-7957)

The use of the closely matching emission of GaAs and the spectral response of silicon detectors are proposed as an optical method of monitoring overall nuclear detector system response. A GaAs diode is a high-speed current device which emits light with an intensity linearly related to the electrical input over a wide range and which has a frequency response well beyond that of normal silicon detectors. The speed of the GaAs source permits overall evaluation of the silicon detector and its associated circuitry. Where applicable, the optical monitoring of nuclear detector systems with compact GaAs sources offers a highly flexible alternative to isotope and electrical pulse methods. Experimental behavior of some typical sources and detectors and the results of a procedure developed to monitor a nuclear pulse detector system are presented. (auth)

28670 IMPROVEMENT OF WIRE CHAMBER RESOLUTION, MULTIPLE EVENT CAPABILITY, AND OTHER TECHNIQUES WITH PROGRAMMED DISCHARGE. M. J. Neumann and T. H. Sherrard (Univ. of Lhicago). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 379-85(Feb. 1965).

Spark chamber and circuit development for computer-wire chamber systems is described, based on programmed discharges added to an initial high-voltage pulse. The basic principle is that the discharge caused by an ionizing particle is converted by an appropriate supply circuit to a secondary discharge, which matches without excessive energy dissipation the requirements of the electronic retrieval system and does not diffuse beyond its original spatial extent. It is shown that it is possible to record both the x and y coordinates of a single spark without dangerous over-voltage on the detector array, and that one can hold the secondary discharge long enough to act as the sole memory element in the system. This leads to the possibility of retrieving correlated coordinates from multiple events with minimum computer time as well as improved recovery time. (auth)

28671 DESIGN AND CALIBRATION OF A BROAD RANGE MAGNETIC NEUTRON SPECTROMETER. C. M. Cialella (Ballistic Research Labs., Aberdeen Proving Ground, Md.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 400-6(Feb. 1965).

A broad-range, low-deflection magnetic neutron spectrometer was constructed to measure the neutron spectrum from pulsed and steady-state sources. The instrument will cover an energy range of from 1 to 15 Mev and is designed for an energy resolution of approximately 10%. A collimated beam of neutrons is allowed to impinge on a thin polyethylene radiator producing recoil protons. A small forward cone of these protons, corresponding to the full energies of the incident neutrons, is allowed to enter the magnetic field. The protons are analyzed and focus at some point outside the magnetic field. The focal line is straight and makes about a 10° angle with the pole piece edge. With 6-Mev incident neutrons, a 0.001-in. radiator, and a 0.5-in. slit width, the energy resolution is 9.3% and the efficiency is 5.1×10^{-8} counts per neutron incident on the radiator. (auth)

28672 THE DESIGN OF A GENERAL PURPOSE RADIOACTIVE ISOTOPE SCANNER WITH DIGITAL READOUT FOR MEDICAL DIAGNOSTIC PURPOSES. Arvid Lundy and Michael Trump (Memorial Hospital for Cancer and Allied Diseases, New York). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 415-20(Feb. 1965).

A general purpose medical scanner using a digital data recording system is described. The need for such apparatus is briefly discussed, and the organization of the data-recording portion is described in detail. (auth)

28673 REACTOR GASEOUS ACTIVITY MONITORING. A. MacKenzie and N. M. Sutherland (Nuclear Enterprises (G.B.) Ltd., Edinburgh). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 421-30(Feb. 1965).

The physical design of detector heads for monitoring the activity in gas flow circuits commonly met in reactor systems is considered, particular attention being given to detectors of the scintillation type. The detailed requirements of the electronic system which is used with the detector heads to form complete monitors is then described, reference being made to the conventional principles of electronic design giving fail-to-safety operation and built-in self-checking facilities. Typical practical systems which have been designed for use on gas circuits of experimental, materials testing, and power reactors are also described. (auth)

28674 THE USE OF BULK SEMICONDUCTOR MATERIAL FOR ABSORBED-DOSE MEASUREMENTS. R. F. Bass and O. L. Curtis, Jr. (Northrop Corp., Newbury Park, Calif.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 472-7(Feb. 1965).

Energy absorption measurements were performed in three flash x-ray environments using silicon. The technique involves measuring the change in conductivity produced by pulsed irradiation of bulk samples. It is essential that the minority carrier lifetime be long compared to the radiation pulse. If the pulse is long compared to the lifetime, this technique can be employed, but it then requires measurement of the lifetime. To provide confidence in the technique, measurements were performed using a variety of sample conditions. The resistivity, geometry, contacts, and surface conditions were varied. Lead shielding eliminated contact effects. Effects of air ionization, secondary electron production, sample homogeneity, and x-ray scattering were also determined. Internal x-ray absorption was measured. The results indicate that simple application of this procedure leads to measurement of absorbed doses with a precision of the order of 5 to 10%. (auth)

28675 MEASURING CONCRETE DENSITY BY GAMMA RAY TRANSMISSION. K. Preiss (Univ. of Illinois, Urbana). Mater. Res. Std., 5: 285-91(June 1965).

The equation relating count rate R with specimen density ρ, thickness x, and chemical composition, for an apparatus with a collimated cesium-137 source and sodium iodide

scintillation counter, is shown to be $R = R_0 \exp(-N_A X \rho \beta x)$ where R_0 and β are apparatus constants, X depends upon the chemical composition of the specimen, and N_A is Avogadro's number. Using this equation, accurate correction can be made to the count rate reading for changes in thickness and chemical composition of a specimen. For the apparatus described, it was found by experiment and calculation that 90% of the reading was due to concrete with within a radius of 0.4 in. of the center-line. Analysis of the errors in the method showed that the accuracy of the reading was limited only by the heterogeneity of the concrete specimen. (auth)

28676 PHOTOGRAPHIC DOSIMETRY WITH SCINTILLATORS. L. Argiero, C. Gianino, and A. Rindi (CAMEN, Pisa, Italy). Minerva Nucl., 9: 103-8(Mar.-Apr. 1965). (In Italian)

The possibility of using crystal scintillators in photographic dosimetry was investigated using dental film placed between two scintillators. Dosimeters were developed for x and gamma radiations and for neutrons. SPE or CsI crystals were used for x and gamma radiations, and ^{10}B enriched ZnS crystals were used for neutrons. Choice of film was dependent on the sensitivity required. Results suggested that a neutron dosimeter with independent energy response is feasible. (H.G.D.)

28677 CALORIMETRIC MEASUREMENTS OF IONIZING RADIATION. IV. ENERGY FLUX IN 6 Mv X-RAY BEAM. Syubo Sakata and Takeshi Hiraoka (National Inst. of Radiological Sciences, Chiba, Japan). Nippon Igaku Hoshasen Gakkai Zasshi, 24: 1105-88(Dec. 1964). (In Japanese)

The x-ray output from a 6-Mev linear accelerator is measured in intensity units (ergs/cm^2 R) using a calorimeter. The calorimeter consists of a 5 cm × 8 cm lead cylinder for use as the x-ray energy absorber, thermistors embedded in the cylinder for temperature detection, and the Wheatstone bridge including those thermistors. An unbalance of the bridge caused by the x-ray input is amplified and recorded momentarily. The x-ray output is measured in roentgen/min with a commercial r-meter. Combining both results, the energy flux per roentgen in the 6-Mv x-ray beam is experimentally evaluated to be 3280 ± 128 ergs/cm^2 R. The energy flux per roentgen is theoretically estimated at 3342 ergs/cm^2 R by an approximate calculation assuming that the 6-Mv x-ray beam is equivalent to a monoenergetic one of 1.4-Mev, since the effective energy of 6-Mv x rays can be determined to be 1.4 Mev by the HVL measurements. The good agreement between experimental and calculated results indicates that even in Mv range the quality of white x rays can be defined satisfactorily by the effective energy of the x rays. (auth)

28678 IMPROVEMENT OF THE ENERGY RESOLUTION POWER OF LOW-PRESSURE GASEOUS SCINTILLATORS BY APPLICATION OF A UNIFORM ELECTRIC FIELD. J. L. Teyssier, D. Blanc, and H. Brunet (Centre de Physique Nucleaire, Toulouse). Nucl. Instr. Methods, 33: 359-60(Mar. 1965). (In French)

The reenforcing effect of a uniform electric field on the emission of light by a rare gas excited by alpha particles was investigated. The rare gas used was argon under a pressure of 450 torr. The results confirm the hypothesis of an electronic process in the presence of an electric field and indicate the possibility of obtaining a suitable resolution power at low pressures in gas scintillators. (J.S.R.)

28679 FABRICATION OF THIN CsI(Tl) SCINTILLATION LAYERS. G. Hrehuss and I. Borbely (Central Research Inst. for Physics, Budapest). Nucl. Instr. Methods, 34: 37-9(Apr. 1965).

The preparation and performance of thin (up to about 5 mg/cm^2) homogeneous CsI(Tl) scintillation layers of large surface are described. (auth)

28680 COUNTER TELESCOPES FOR THE STUDY OF (n, charged particle) REACTIONS. G. Paic, I. Slaus, and P. Tomas (Inst. "Ruder Boskovic," Zagreb). Nucl. Instr. Methods, 34: 40-4(Apr. 1965).

A gas telescope (three CO_2 proportional counters and a CsI(Tl) scintillation counter) and a semiconductor telescope (three surface-barrier detectors) are briefly described, and their merits and performance in charged-particle detection and discrimination in neutron reactions are discussed. (D.C.W.)

28681 PROPERTIES OF SCINTILLATION DETECTORS. Tomota Nishi (Kyoto Univ.) and Masahiro Oura. Oyo Buturi, 33: 377-89(June 1964). (In Japanese)

The important studies made in the field for the past ten years are summarized and discussed. After the introduction in section 1, section 2 deals with papers on basic studies of the resolution power of γ-ray spectrometers with an NaI(Tl) single crystal, the statistical analysis of the experimental resolution power into the intrinsic and residual resolutions, and the contribution of the Tl concentration and dislocation density in the crystal to the intrinsic resolution. The intrinsic resolution is found to be considerably influenced by the non-linear response of the NaI(Tl) crystal to the energy of the radiant rays. Section 3 deals with the fundamental characteristics and responses of NaI(Tl) and CsI(Tl) crystals from the standpoint of actual phenomena. In section 4, results from 11 papers on temperature coefficients of the various scintillation detector systems (NaI(Tl) crystals and photomultipliers) are summarized in one table. It is concluded that great difficulties lie in the complete interpretation of the scintillation characteristics, and the solid-state physics studies now being conducted at various places may solve these problems. (NSA of Japan)

28682 ION-CHAMBER CURRENT FLUCTUATIONS PRODUCED BY NEUTRON AND GAMMA SOURCES. J. Richard Trinko, Jr. (Univ. of Tennessee, Knoxville) and S. H. Hanauer. Trans. Am. Nucl. Soc., 8: 60-1(May 1965).

28683 MONTE CARLO CALCULATIONS OF SEMICONDUCTOR DETECTOR RESPONSE TO GAMMA RAYS. K. M. Wainio and G. F. Knoll (Univ. of Michigan, Ann Arbor). Trans. Am. Nucl. Soc., 8: 61-2(May 1965).

28684 CALCULATED GAMMA-RAY PHOTOFRACTIONS FOR WELL-TYPE SCINTILLATION DETECTORS. B. J. Snyder and G. F. Knoll (Univ. of Michigan, Ann Arbor). Trans. Am. Nucl. Soc., 8: 62(May 1965).

28685 ABSOLUTE LIQUID-SCINTILLATION RATE CONSTANTS AND FLUORESCENCE EFFICIENCIES. H. R. Lukens, Jr. (General Atomic, San Diego, Calif.). Trans. Am. Nucl. Soc., 8: 63-4(May 1965).

28686 DESIGN EQUATIONS FOR A NEUTRON-FLUX MONITOR USING THE CURRENT FLUCTUATIONS FROM A DETECTOR. J. P. Neissel (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 8: 64-5(May 1965).

28687 STEADY-STATE GAMMA-RAY DETECTION USING FERROELECTRICS. Donald D. Glower (Ohio State Univ., Columbus) and Donald L. Hester. Trans. Am. Nucl. Soc., 8: 66-7(May 1965).

28688 A MONITOR FOR THE RAPID DETECTION OF FRESH FISSION PRODUCTS IN A GAS STREAM. R. Curtis Lee (General Electric Co., Cincinnati) and George K. Schweitzer. Trans. Am. Nucl. Soc., 8: 68-9(May 1965).

28689 MONITORING NEUTRON FLUX WITH ARGON GAS—NEW DEVELOPMENTS. Charles R. F. Smith (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 8: 71-2(May 1965).

28690 SILICON CARBIDE HIGH-TEMPERATURE NEUTRON DETECTORS FOR REACTOR INSTRUMENTATION. R. R. Ferber and G. N. Hamilton (Westinghouse Electric Co., Pittsburgh). Trans. Am. Nucl. Soc., 8: 72-3 (May 1965).

28691 PROTON-RECOIL SPECTROMETER FOR FAST-NEUTRON SPECTRA. L. Harris, G. F. Knoll, and J. S. King (Univ. of Michigan, Ann Arbor). Trans. Am. Nucl. Soc., 8: 73(May 1965).

28692 USE OF RELIABILITY THEORY TO EXAMINE SAFETY-SYSTEM DESIGNS. G. C. Rudy and J. T. Stone (Allis-Chalmers Mfg. Co., Bethesda, Md.). Trans. Am. Nucl. Soc., 8: 138-9(May 1965).

28693 PERSONNEL DOSIMETERS WITH RADIATION ELEMENTS. R. Hosemann and H. Warrikhoff (Fritz-Haber-Institut der Max-Planck-Gesellschaft, Berlin). Vienna, International Atomic Energy Agency, World Health Organization, 1965, Preprint No. SM-56/22, 8p. (CONF-650302-8)

From IAEA Symposium on Personnel Dosimetry for Accidental High-Level Exposure to External and Internal Radiation, Vienna.

The radiation element is a vacuum diode, the electrodes of which emit a different charge of electrons per unit of irradiation. Since the electrons ejected leave one electrode with a high energy the other electrode can be charged to proportional high voltages without any auxiliary power. Accerding to this property these direct reading systems are called radiation elements. To measure X- and γ-rays the one electrode consists of lead, the other of carbon. The wavelength independence with regard to the r-unit was obtained by the so-called electron-filtering method. The sensitivity is approximately 0.5 V r ± 8% within the range from 80 kev to 1.25 Mev. (Full scale 200 to 2000 R either linear or quasi-logarithm.) To measure slow and fast neutrons the induced β-activity of the electrodes will charge the built-in electrometer. There are possibilities to measure gammas as well as neutrons in rem units by one instrument. The neutron sensitivity of a gamma-element can be made definitely zero, but the gamma sensitivity of a neutron element will raise some difficulties. The outstanding advantages of these instruments are: self-powered systems, always ready to measure, unlimited storing time, no batteries or charging units, extremely low fading because of the use of vacuum and quartz for isolation; quantitative measurement of the highest attainable dose rates because of no recombination effects (vacuum); and either direct or indirect systems. The direct reading instrument contains the radiation element and the electrometer in the same vacuum vessel. There are no electrical contacts outside of the instrument. Cylindrical and spherical designs of the element are preferable to other constructions. The outer dimensions of the instrument will be the same as those of the commonly used pen-type dosimeters. Each system contains a discharge switch and a control unit. (auth)

28694 IMPROVEMENTS IN OR RELATING TO RADIATION MONITORS. Harry Bisby, Frank Daniel Seymour, and Geoffrey Frank Snelling (to United Kingdom Atomic Energy Authority). British Patent 984,240. Feb. 24, 1965. Filed May 10, 1962.

An apparatus used in association with a weir cell to measure alpha particles from a liquid flowing through the cell is provided with a protective membrane interposed between the liquid and the monitor screen to prevent contamination of the screen. The membrane preferably is a P.T.F.E. film in the form of a long strip wound between two rotatable spools. The weir cell is also provided with means for freeing the liquid of air bubbles and maintaining a laminar flow of liquid through the cell. (A.G.W.)

28695 IMPROVEMENTS IN OR RELATING TO CALIBRATION DEVICE FOR CALIBRATING RADIATION SENSITIVE INSTRUMENTS. Kenneth Edward Gordon Perry (to United Kingdom Atomic Energy Authority). British Patent 984,834. Mar. 3, 1965. Filed Oct. 5, 1962.

A calibration device is intended for testing the calibration of radiation monitors sensitive to γ radiation and having an outer casing at least a part of which is penetrable by β particles. The device includes a β source in a mounting suitable for mounting on a wall. The mounting has supports that can be engaged by the monitor to bring the monitor's β window into coincidence with the source. A shutter between the source and the casing of the calibration device can be moved to expose the source by known amounts. The device does not provide an absolute calibration of the monitor for γ radiation but it appears to be sufficiently precise for most practical purposes. (A.G.W.)

Radiation Effects

28696 (AD-607561) SECONDARY BREAKDOWN, RADIATION RESISTANCE AND FREQUENCY RESPONSE OF SILICON TRANSISTORS. Bernard Reich and Edward B. Hakim (Army Electronics Labs., Fort Monmouth, N. J.). June 1964. 20p. (USAEL-TR-2463). $1.00(CFSTI).

Considerations that have to be taken into account when choosing a transistor which has good neutron radiation resistance and, in addition, secondary breakdown performance are given. There appears to be a point where optimum performance is obtained considering both requirements. However, the representation indicated can only be considered a static case since secondary breakdown is itself dependent on the amount of neutron exposure the device receives. (auth)

28697 (FTD-TT-64-1164) BEHAVIOR OF DIFFUSION-BASE GERMANIUM TRANSISTORS IN A GAMMA-RAY FIELD. A. V. Yurovskii (Yurovskiy) and M. P. Sinyukov. Translated from Elektronno-Dyrochnye Perekhody v Poluprov., Akad. Nauk SSSR, Akad. Nauk Uz. SSR, Tashkentsk., 315-18(1962). 8p. CFSTI.

The effects of γ radiation from a ^{60}Co source on the electrical properties of high-frequency diffusion-base Ge transistors were measured during irradiation and as a function of dose. The electrical properties measured were the coefficient of amplification of the current, the output conductance, and the feedback current of the collector. The coefficient of amplification remained at a constant value. The output conductance remained constant to a dosage of 8.3 R, at which time it increased greatly. The feedback current increased steadily to a value greater than 200% which could not be measured on the control instrument. The electrical properties were measured two months later and the values are given. (W.L.G.)

28698 SURFACE EFFECTS OF GASEOUS IONS AND ELECTRONS ON SEMICONDUCTOR DEVICES. Peder J. Estrup (Bell Telephone Labs., Inc., Murray Hill, N. J.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 431-6(Feb. 1965).

Previous investigations indicated that radiation surface effects on semiconductors largely are due to ions produced in the gas near the semiconductor surface. These effects were studied directly by a gas-discharge technique. Large electrical changes could be induced by either positive or negative species; in the case of transistors, the reverse current across the base-collector junction could increase by several orders of magnitude. The relaxation of the effects may take many hours. The nature of the surface effects was investigated by observations of the current-voltage characteristics and of the action of various gases (O_2, H_2O) after ion exposure. The main effects were due to inversion layers which might be induced on either side of a junction. The decay of the surface effect could be accelerated by heat, light and the presence of certain gases. In addition, the surface charge could be removed very rapidly by exposure to species of opposite charge to those creating the inversion layer. (auth)

28699 THE SELECTION OF TRANSISTORS FOR USE IN IONIZING RADIATION FIELDS. Charles W. Bostian and Edward G. Manning (North Carolina State Univ., Raleigh). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 437-43(Feb. 1965).

The principal effects on transistors subjected to prolonged ionizing radiation fields are the reduction of the forward current gain and the increase of the collector-base leakage current (I_{cbo}). Thin base, high frequency transistors are more resistant to gain degradation than low frequency units. Leakage current increases arise from direct generation of carriers by the ionizing radiation,

by the formation of surface channels, and damage to the lattice structure. The useful life of equipment can be increased by the selection of transistors which minimize surface channeling. The extent to which channeling will take place is strongly determined by the presence of surface defects and hence can be predicted by a microplasma noise test. Mechanical positioning problems can frequently be disclosed through a brief radiation screening test. In addition, units having abnormally high initial I_{cbo} are subject to rapid failure. (auth)

28700 INVESTIGATION OF A PRAGMATIC TECHNIQUE FOR PRESELECTING RADIATION RESISTANT SEMICONDUCTOR DEVICES. M. L. Rossi and G. H. Bolles (Grumman Aircraft Engineering Corp., Bethpage, N. Y.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 444-9(Feb. 1965).

A non-destructive method for selecting radiation-resistant semiconducting devices was investigated. The technique involves the controlled laboratory irradiation of devices, subsequent temperature annealing, and then use of the devices that are found to be most radiation-resistant. Two series of radiation-annealing experiments were performed. In the first, the radiation damage caused by 6.6×10^{15} 1-Mev electron/cm^2 was annealed from the 1N645 silicon diodes. In the second series, radiation damage caused by 1.9-Mev electrons for similar integrated flux levels was annealed from both 1N645 and 1N1563A diodes, and on re-irradiation the annealed devices were as radiation-resistant as the first time. (auth)

28701 RADIATION EFFECTS IN METAL-OXIDE-SEMICONDUCTOR TRANSISTORS. J. Raymond, E. Steele, and W. Chang (Northrop Ventura, Newbury Park, Calif.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 457-63(Feb. 1965).

The behavior of metal-oxide-semiconductor (MOS) transistors was studied in both the ionizing radiation and neutron environments. Included in the study are both depletion and enhancement devices. Behavior in the radiation environment is considered in terms of the circuit application of the devices. Transient response in the flash x-ray environment is characterized in the common source configuration as a function of the device operation point and generator impedance. Analysis of experimental data shows that the radiation induced transient drain current consists of two components, the drain-substrate diode photocurrent and the secondary drain photocurrent. A radiation-inclusive small signal equivalent circuit was established to predict the device response. Predicted responses agree with the experimental data quite well. For permanent damage study, MOS transistor specimens were irradiated at the Northrop TRIGA reactor at steps of integrated fast neutron flux up to 5×10^{14} nvt. Both the degradation of the device small signal parameters and a substantial shift in the d-c operating characteristics were observed. The change in the small signal parameter is less when the device is biased at a constant quiescent drain current than when it is biased at a constant gate voltage. (auth)

28702 RADIATION DAMAGE IN SILICON P-I-N LITHIUM-DRIFT SOLAR CELLS. Norman J.Gri (AVCO Corp., Tulsa, Okla.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 464-71(Feb. 1965).

The effects of electron, proton and neutron irradiation of silicon lithium-drift p-i-n diodes are given in terms of optical and x-ray response changes. All diodes used for this study were fabricated from high oxygen content Czochralski silicon. The long-term compensation stability exhibited by these diodes is attributed to the decreased effective lithium ion mobility in this material. The junction capacitance changes as a result of irradiation indicate that, in addition to the usual minority carrier lifetime degradation, there is also a redistribution of the lithium ions within the drifted region. This redistribution has the form of an increased lithium gradient at the junction, resulting in a narrower depletion width. The two-fold effect of a reduction in active volume together with a degradation of carrier lifetime explains the experimentally observed result that the lithium-drift p-i-n diodes are more susceptible to radiation damage than the p-n structure. The experimental data also indicate, however, that for operation in a non-nuclear environment the p-i-n structure can be made more efficient than the p-n structure. This is particularly true for photons having energies near the cutoff energy of 1.1 ev or above 100 kev where photoelectric cross sections are insignificant and Compton processes predominate. (auth)

ISOTOPE TECHNOLOGY

General

28703 ZERO-GRAVITY RADIOTRACER PROPELLANT GAUGE. James F. Wakeman and Bruce Burns (TRW Space Technology Labs., Inc., Redondo Beach, Calif.). Trans. Am. Nucl. Soc., 8: 80-1(May 1965).

28704 RADIOACTIVE SOURCES. Guy Courtois and Pierre Le Clerc (to Commissariat a l'Energie Atomique). Canadian Patent 689,687. June 30, 1964. Priority date Mar. 17, 1960, France.

A radioactive source resistant to mechanically, thermally, and chemically severe conditions is comprised of a radioactive substance embedded or incorporated in a ceramic type material that is devoid of potassium and sodium and is available under the registered trade mark of Pyroceram. The mass of ceramic material is housed in a stainless steel tube closed by a plate. The stainless steel container is disposed in an alumina envelope closed by a plug. (B.L.M.)

Industrial Applications

Refer also to abstracts 28059, 28742, and 28743.

28705 (TID-21628) RADIATION-PASTEURIZING FRESH STRAWBERRIES AND OTHER FRESH FRUITS AND VEGETABLES: ESTIMATES OF COSTS AND BENEFITS. (Economic Research Service, Washington, D. C.). Mar. 1965. Contract AT(49-11)-2085. 30p. (ERS-225). Dep.; $2.00(cy), 1(mn) CFSTI.

Economic feasibility and assets of the fresh fruit radiopreservation are discussed with emphasis on strawberries. It is suggested that radiation-pasteurizing of strawberries would reduce spoilage loss by at least enough to pay the cost of treatment. Although considerable potential exists for spoilage reduction of fresh peaches, tomatoes, oranges, and grapefruit, more technical information is needed before economic feasibility estimates can be made for these fruits. Operation costs and utilization efficiencies of irradiation facilities are also considered. (H.G.D.)

28706 THE CHOICE OF RADIONUCLIDES FOR LUMINOUS PAINTS IN THE WATCHMAKING INDUSTRY. J. Mehl. Atomkernenergie, 10: 115-26(Mar.-Apr. 1965). (In German)

The 13 radionuclides, which fulfill some basic requirements of the luminous paint industry and radiation protection, were analyzed to determine their suitability for use in radioluminous paints for timepieces. The analysis was based on the assessment of the specific activity of the paint and the total activity per timepiece required to produce adequate luminosity. The characteristic data of the 13 radionuclides were compared with those of radium. The comparison included the cost of the radioactive material, external radiation exposure, risks of exposure to internal radiation in the event of an accidental intake, or risks from continuous intake of spurious amounts of the radioactive material. Reference was also made to the detectability of the radionuclides by radiation monitoring and to the behavior of the radionuclides in chemical processing. Specification of the conditions of their use on timepieces are given to enable the requirements of radiation safety and health protection to be adequately met. (auth)

28707 SOME RECENT AUSTRALIAN DEVELOPMENTS IN THE APPLICATION OF RADIOISOTOPES AND RADIATION SOURCES. J. G. Clouston, W. R. Ellis, U. Engelbert, J. N. Gregory, G. L. Miles, and J. S. Watt (Australian Atomic Energy Commission Research Establishment, Sutherland, New South Wales). Atompraxis, 11: 208-14 (Apr. 1965).

A review is given of developments in radioisotope and radiation applications in Australia since 1958. The organization and facilities of the Isotope Division of the Australian Atomic Energy Commission are described and technical developments in radiation sources, radiation technology, industrial research, and hydrology are discussed. Techniques for producing high specific activity ^{60}Co and γ-excited x-ray sources are discussed. Details of the gamma irradiation facilities using ^{60}Co and spent reactor fuel elements are presented. Results of studies made to assess the possible use of gamma irradiation for post-harvest disinfestation and food preservation are outlined. Examples are given of some industrial and field experiments using radioisotopes, and research aimed at improving existing techniques. The contribution of radioisotopes to the development of Australia is stressed. (auth)

28708 INFLUENCE OF 31 Mev ELECTRON-RAYS ON POTATOES. A. Berger and J. Wolf (Bundesforschungsanstalt fur Lebensmittelfrischhaltung, Karlsruhe, Ger.). Atompraxis, 11: 214-18(Apr. 1965). (In German)

Selected seed potatoes were irradiated with electron-beams at 31 Mev. Just as in potatoes irradiated with x rays the weight loss diminished with an increasing dose of electrons. The limiting value to suppress sprouting for 30 weeks of storage time was 20 kr, which was more than by irradiation with 60-kev x rays. The correlations between CO_2 formation during storage time and the irradiation dose as well as the artificial radioactivity caused by irradiation with electrons were measured. (auth)

28709 DENSITY MEASUREMENT OF COMPRESSED STOCK COAL BY GAMMA RADIATION. Takeyuki Taguchi (Shikoku Electric Power Co., Inc., Japan). Karyoku Hatsuden, 15: 785-8(Oct. 1964). (In Japanese)

Density measurements of compressed stock coal by gamma radiation in coal-burning power stations are discussed. The gamma radiation is backscattered by the surrounding medium. With increasing coal density, the probability of scattering by simple collisions increases and hence the count rate increases. This scattering gives a measure of the coal density. In a study 2300 tons of bulk coal were piled up hemispherically with a bulldozer (37 m dia at the base and 4.8 m maximum height). Ten steel tubes (47 mm ID) were hammered into the coal pile longitudinally at 10 random positions. A probe with a ^{137}Cs gamma source lead shield, and G-M counter was lowered into the tubes. The gamma method was compared with the boring, casing, and geographic survey methods for measurement of the density of compressed stock coal. As a result, it was found that there is a large discrepancy between the gamma method and the geographic calculation method. The discrepancy may be due to the disturbance of the surrounding coal caused by hammering the steel tube into the compressed stock coal. A gamma method is proposed by the author in which the hole for the tube is first made before the insertion of the tube. (NSA of Japan)

28710 THE GROWTH, REPRODUCTION, LONGEVITY, AND HISTOPATHOLOGY OF RATS FED GAMMA-IRRADIATED FLOUR. Ian J. Tinsley, Jesse F. Bone, and Edward C. Bubl (Oregon State Univ., Corvallis). Toxicol. Appl. Pharmacol., 7: 71-8(Jan. 1965).

Flour was packed in No. 10 cans and irradiated by exposure to γ radiation of spent fuel rods. The two levels of irradiation used in this study (37,200 and 74,400 rad) did not adversely affect the physical qualities of the flour. Control (nonirradiated) flour was stored at 0°F and irradiated flour was stored at room temperature for a min of 3 months before incorporation into the ration. To simulate the baking process, flour was thoroughly mixed with water and baked. Sufficient baked flour was then incorporated into the ration to provide 35% of the ration solids. The 37,200-rad and 74,400-rad irradiated flour and non-

irradiated flour were incorporated into three separate rations which were fed to three generations of Wistar rats. Fifty animals (25 males, 25 females) were placed on each ration. In each of the three generations, growth rates and food intakes were observed for the first 14 weeks. After this period, the females were carried through two pregnancies. The first generation animals were then maintained for a max of two years as a longevity group. Tumor pathology was less than half that found in animals on other standard diets (19 cases) and occurred slightly more frequently (11) in females than in males. Malignancies were less frequent (5) than benign tumors (14). No significant correlation with radiation level was found. The malignancies were more numerous in the females (4) than in the males (1). Three of these were adenocarcinomas of the mammary gland. No deleterious effects were observed that could be attributed to the irradiation variable. On the basis of this experiment there is no apparent toxic hazard involved in the ingestion of flour irradiated to a level of 74,400 rad. When compared with the parent-generation animals, second- and third-generation animals showed higher growth rates but inferior breeding performance. The survival of animals on the flour ration was considerably lower than that obtained with animals raised on peach and pork rations. To what extent this difference could be attributed to diet or exogenous factors was not apparent. (BBB)

28711 PROCEEDINGS [OF THE] ATOMIC INDUSTRIAL FORUM 1964 ANNUAL CONFERENCE, NOVEMBER 30–DECEMBER 3, SAN FRANCISCO, CALIFORNIA. VOLUME 3. Robert N. Ubell, ed. New York, Atomic Industrial Forum, Inc., 1965. 66p. (CONF-641112)

Part 3 of the Proceedings of the Atomic Industrial Forum 1964 Conference is presented. Eight papers and a panel discussion are included. Separate abstracts were prepared for two of the papers. (M.C.G.)

28712 FOOD IRRADIATOR AND METHOD. O. A. Kuhl and A. B. Oltmann (to U. S. Atomic Energy Commission). U. S. Patent 3,192,054. June 29, 1965.

The irradiation of perishable foodstuffs in sub-sterilization dosages to extend the refrigerated life of the foodstuffs is considered. By this invention, the food is packaged and then irradiated by a plurality of spaced gamma sources that are stored beneath the line of movement of the packages. The packages come to a halt over the sources that are then raised to places between adjacent packages. After a period of irradiation the sources are withdrawn and the packages are indexed across to place successive packages in irradiation positions. (AEC)

Power Application

28713 (MND-3043-1) STRONTIUM 90-FUELED THERMOELECTRIC GENERATOR POWER SOURCE FOR FIVE-WATT U. S. COAST GUARD LIGHT BUOY. Addendum I. W. Kenneth Nichols, Jr., and William A. McDonald (Martin Co., Baltimore, Md. Nuclear Div.). Apr. 1964. Contract AT(30-1)-3043. 36p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

The refueling, testing, modification, and operational performance of the ^{90}Sr-fueled SNAP-7A power supply is described. SNAP-7A is a thermoelectric generator with an output power of 5 watts. (T.F.H.)

28714 (SC-DC-65-1131) SPACE POWER SUPPLIES. [V. E. Blake] (Sandia Corp., Albuquerque). [Jan. 1965]. Contract [AT(29-1)-789]. 9p. (CONF-650110-1). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From the American Nuclear Society Meeting, Santa Fe, N. Mex.

A brief survey is given of the history of the development of radioisotope, reactor, and solar-cell space power supplies. Power supplies using heat directly—the ROVER rocket propulsion reactor, the PLUTO nuclear ramjet, and the POODLE rocket thruster using ^{210}Po—are described. The power systems using heat to generate electricity are discussed. Development of the reactors SNAP-2, SNAP-8, SNAP-10A, and SNAP-50 is surveyed. Requirements of isotope generators and the characteristics of ^{238}Pu, ^{90}Sr, ^{137}Cs, ^{244}Cm, and ^{210}Po for SNAP applications are discussed. The isotope generators SNAP-3, SNAP-9A, SNAP-11, SNAP-17, and SNAP-19 are described. (M.J.T.)

28715 DEVELOPMENT OF THE GAMMA RADIOISOTOPE THRUSTOR. William H. Buford, Jr. and Charles R. Greenhow (Marquardt Corp., Van Nuys, Calif.). Trans. Am. Nucl. Soc., 8: 166-7(May 1965).

28716 LEACH RATE OF $Sr^{90}TiO_3$ RADIOISOTOPIC POWER FUEL. R. E. McHenry (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 172-3(May 1965).

Separation and Production

See also CHEMISTRY — Separation Processes and Procedures.

28717 (MLM-1221) MOUND LABORATORY PROGRESS REPORT FOR OCTOBER 1964. J. F. Eichelberger, G. R. Grove, and L. V. Jones (Mound Lab., Miamisburg, Ohio). Oct. 22, 1964. Contract AT-33-1-GEN-53. 24p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

An extension of the heat-output measurements to 104 and 138 days of two ^{147}Pm samples gave a weighted grand mean half-life for this isotope as 2.6226 ± 0.0002 years with absolute limits of 0.002 year. Trioctyl phosphine oxide (TOPO) is being evaluated for ^{234}U separation from other heavy metals prior to purification by anion exchange. A low-abundance alpha group at 4.21 Mev was assigned to ^{208}Po decay. The result is in agreement with the known first excited state of the daughter nucleus ^{204}Pb at 899 kev. After 124 days and 20 observations, the method of decaying pairs yields a half-life value for ^{210}Po of 138.65 ± 0.07 days. The neutron emission rates of Pu–Be neutron sources are being measured to determine the effect of the ingrowth of ^{241}Am. The thermal diffusion column system for enriching ^{13}C in CH_4 was converted from a 12-column, 10-stage unit to a 12-column, 8-stage unit in accordance with recent calculations predicting a greater separation efficiency for ^{13}C. Several modifications to the carbon dioxide-monoethanolamine chemical exchange system improved the efficiency of the system. The column hold-up was reduced and loss of solvent was minimized. Draw-off of ^{22}Ne was continued in the batch processing of intermediate material used for enriching ^{21}Ne. In a four-stage thermal diffusion column cascade, ^{36}Ar (>99.98%) was withdrawn at a rate of 1.4 ml per hour. In a five-stage cascaded swing system with a reservoir at both ends, the ^{131}Xe in the bottom stream of the thermal diffusion column cascade was reduced to 0.7% from fission-product Xe. Vapor pressure bulb temperatures of 1.22°K and less than 0.66°K were obtained by pumping and adiabatic demagnetization, respectively, on the new ^{3}He thermometer system. Calorimetric half-life data of a radioactive isotope are fitted by least squares to an equation containing two constants, which can be determined by any one of five computer programs. As an alternate to internal-gas-phase proportional counting for detection of trace quantities of ^{85}Kr in Kr and Xe, work was started on the quantitative determination of conversion electrons from ^{85}Kr in a thin film of material condensed cryogenically. Preliminary experiments with Li drift detectors showed that this method possesses the energy resolution required for quantitative measurement. In particular, resolution of conversion electrons at 623 kev and 655 kev arising from conversion of the 661-kev gamma ray from ^{137}Cs is satisfactory. Twelve cylinders of P-10 gas (90% Ar 10% CH_4) were found to contain 1×10^{-8} mole % tritium as determined by liquid scintillation counting. A colorimetric method for the determination of Np in the presence of Pu was developed. The method involves solvent extraction of Pu and Np in HNO_3. A study of the gelation time of the system 4,4′-diaminodiphenyl sulfone (DDS)–Epon 828

epoxy resin–trimethoxyboroxine (TMB)–acetone showed that heating DDS with Epon 828 before mixing with the other ingredients led to a shorter cure time than if the four ingredients were mixed at room temperature. This shorter time indicates that reaction takes place between DDS and Epon 828 when the two are heated together. An increase in the concentration of TMB in the system led to a shorter cure time in either case. (auth)

28718 THERMAL DIFFUSION OF $^{16}O/^{18}O$ IN CLUSIUS-DICKEL COLUMNS. COMPARISON OF RESULTS WITH THEORETICAL PREDICTIONS. J. Casas, J. M. Saviron, and M. Quintanilla (Universidad, Saragossa, Spain). Anales Real Soc. Espan. Fis. Quim. (Madrid), Ser. A, 40: 167-74 (July-Aug. 1964). (In Spanish)

The optimum conditions for the separation of oxygen isotopes by thermal diffusion were studied, using ^{18}O-enriched oxygen. Experimental results treated in the light of current theories were found to agree with the latter insofar as optimum pressure is concerned. (auth)

28719 TRANSURANIUM-ELEMENT PRODUCTION IN EPITHERMAL REACTORS. L. G. Epel, J. Chernick, B. Manowitz, and W. E. Winsche (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 8: 57-8(May 1965).

28720 PREPARATION OF XENON-131m, XENON-129m, AND KRYPTON-79. E. H. Acree and R. S. Pressly (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 76(May 1965).

28721 REACTOR PRODUCTION AND CHEMICAL SEPARATION OF CARRIER-FREE P-33 FROM Cl-36 AND ENRICHED S-33 IN THE OAK RIDGE RESEARCH REACTOR. R. E. Lewis and T. A. Butler (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 173-4 (May 1965).

28722 PURIFICATION OF CURIE QUANTITIES OF FISSION-PRODUCED I-131 BY SORPTION ON PLATINUM. F. N. Case and E. H. Acree (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 171(May 1965).

28723 TECHNICAL FEASIBILITY OF RADIOISOTOPE PRODUCTION IN POWER REACTORS. Arthur F. Rupp, J. A. Cox, and F. T. Binford (Oak Ridge National Lab., Tenn.). p.168-79 of "Proceedings [of the] Atomic Industrial Forum 1964 Annual Conference, November 30–December 3, San Francisco, California. Vol. 3." New York, Atomic Industrial Forum, Inc., 1965.

The technical and economic aspects of radioisotope production in power reactors are discussed. Characteristics of power reactors are reviewed. Criteria for radioisotopes suited for power reactor production are outlined. Production of ^{238}Pu, ^{210}Po, ^{242}Cm, ^{244}Cm, ^{170}Tm, ^{60}Co, and ^{14}C is considered. It was concluded that it is technically and economically feasible to produce certain radioisotopes in power reactors. (M.C.G.)

28724 IMPROVEMENTS IN PROCESSES AND APPARATUS FOR PREPARING DEUTERIUM-ENRICHED AMMONIA BY ISOTHERMAL ISOTOPE EXCHANGE. (to Commissariat a l'Energie Atomique). British Patent 985,782. Mar. 10, 1965. Priority date, Dec. 14, 1960, France.

A process is reported for the preparation of D_2-enriched NH_3 by isothermal isotope exchange in one or more reactors between liquid NH_3 and NH_3 synthesis gas containing D_2 in the presence of a catalyst in solution in the liquid NH_3. At least one catalyst reinjection loop is provided and is connected to at least one of the reactor(s). The catalyst leaving the reactor(s) is recovered in a dry condition and is redissolved in part of the liquid NH_3 supplied to the top of one of the reactors in order to form a concentrated solution that is passed in counter-current to the NH_3 synthesis gas withdrawn from the top of the reactor(s). The solution is subsequently injected into the remainder of the NH_3 supply to the reactor(s). The NH_3 synthesis gas is reinjected at a point of iso-concentration of D_2. (B.L.M.)

MATHEMATICS AND COMPUTERS

Refer also to abstracts 29068 and 29469.

28725 (BNWL-41) LISTIV: A FORTRAN IV GENERALIZED INPUT ROUTINE. D. D. Matsumoto (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Mar. 1965. Contract AT(45-1)-1830. 17p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

The subroutine LISTIV in Fortran IV was written to make the LISTIN-type input possible with two classes of programs: Fortran II codes which are being converted to Fortran IV without extensive revision, and applications in which programming time can be cut and data preparation simplified. The differences between LISTIN and LISTIV are summarized. (L.B.S.)

28726 (CERN-65-16) A SHORT TABLE OF A DEFINITE INTEGRAL INVOLVING A PRODUCT OF BESSEL FUNCTIONS. K. S. Koelbig (European Organization for Nuclear Research, Geneva (Switzerland). May 3, 1965. 30p. Dep.(mn).

Some properties of $F(t,u) = \int_0^1 J_1(t\rho)\, J_0(u\rho)\, d\rho$ are described, and a table for $F(j_{n,m},u)$ with n = 0, 1, 2; m = 1(1)5 and u = 0(0.1)20 is given. (auth)

28727 (CONF-650408-1) THE DATAPOOL CONCEPT. J. A. Warrington. A DATAPOOL SIMULATION SUBROUTINE. E. E. Kazmierczak (Knolls Atomic Power Lab., Schenectady, N. Y.). Mar. 22, 1965. Contract [W-31-109-eng-52]. 17p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From Transac Users Group, San Antonio.

The design of a file management scheme for computer tapes is described. The scheme (called DATAPOOL) is in use at KAPL. The DATAPOOL concept is described, and a program that implements the DATAPOOL concept is shown. (T.F.H.)

28728 (IC/65/35) RELATIONS BETWEEN GREEN FUNCTIONS. C. G. Bollini and J. J. Giambiagi (International Centre for Theoretical Physics, Trieste (Italy)). Apr. 1965. 19p. Dep.(mn).

The Green functions and some relations between them are built up starting from a single function g(z), analytic in the z-plane with a cut running along the negative real axis, and such that $g^*(z) = g(z^*)$. Some spectral representations are discussed. (auth)

28729 (LADC-6451) ON THE DISCRETIZATION ERROR OF THE NUMERICAL SOLUTION OF THE THIRD BOUNDARY VALUE PROBLEM. Neil M. Wigley (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [nd]. Contract [W-7405-eng-36]. 17p. Dep.(mn); $1.00 (cy), 1(mn) CFSTI.

The discretization error arising from the use of the finite-difference method for solving Laplace's equation for a rectangle is studied. A bound is found for this error in the case in which Dirichlet data are prescribed on two opposite sides of the rectangle and Neumann data on the other two sides. The bound is dependent only on the data on the sides. (T.F.H.)

28730 (NIRL/R/73) THE DESIGN OF THE ORION FORTRAN MONITOR SYSTEM. J. W. Gardner and D. A. Harragan (Rutherford High Energy Lab., National Inst. for Research in Nuclear Science, Chilton (England)). Aug. 1964. 69p. Dep.(mn).

The structure of the Fortran Monitor System (FORMAP) as designed for use on the Orion computer at the Rutherford High Energy Laboratory is described. FORMAP controls and directs the processing of programs written in FORTRAN. This processing consists of compiling, editing, and assembling routines into complete object programs ready for execution. FORMAP contains two compilers, FORCOM and FACOM, but only the monitoring, editing, and assembling portions are covered in detail, giving the specifications of the computer languages used. (auth)

28731 (NP-14824) LECTURES ON LOCAL LIE GROUPS AND THEIR REPRESENTATIONS. Matscience Report No. 25. Lochlainn O'Raifeartaigh (Institute of Mathematical Sciences, Madras (India)). 1964. 245p.

The general theory of abstract local Lie groups and the associated transformation groups is discussed. The Lie algebra is introduced; and the reduction to canonical form, classification, root diagrams and construction of irreducible representations are discussed for the case of semi-simple Lie algebras. The problem of constructing all independent invariants for any given Lie group is considered. (L.B.S.)

28732 (ORNL-3743) UTILIZATION OF A PRIORI INFORMATION BY MEANS OF MATHEMATICAL PROGRAMMING IN THE STATISTICAL INTERPRETATION OF MEASURED DISTRIBUTIONS (thesis). W. R. Burrus (Oak Ridge National Lab., Tenn.). June 1965. Contract W-7405-eng-26. 114p. Dep.; $4.00(cy), 2(mn) CFSTI.

A statistical approach is developed for unfolding instrument measurements which are related to an unknown function by a linear integral transformation. If statistical uncertainties are present in the measured function and in the kernel of the transformation, then the use of a priori information is shown to be necessary for a nontrivial solution. Without such information, an infinite-width confidence interval can be found for any nontrivial function of the unknown function. Suitable a priori information, however, nearly always exists in physically motivated problems. The weakest form of a priori information considered is simple nonnegativity. Stronger a priori information, such as smooth or monotonic behavior, can be put in the same form as simple nonnegativity by suitable transformation. The unfolding problem requires two steps: selecting a set of functions of the unknown function to adequately describe the function and then numerically obtaining the width of the confidence interval for each function. Several computational techniques based upon linear and quadratic programming are described. Finally, the method is illustrated by unfolding gamma-ray and neutron spectra from pulse-height distributions obtained with scintillation spectrometers and by solving a poorly conditioned set of equations. (auth)

28733 (ORNL-P-1033) ON NONLINEAR MULTISTEP METHODS FOR ORDINARY INITIAL-VALUE PROBLEMS. William B. Gragg (Oak Ridge National Lab., Tenn.). [1965]. Contract W-7405-eng-26. 9p. (CONF-650207-1). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From Assn. for Computing Machinery Meeting, Huntsville, Ala.

The operator $\alpha_k x_{n+k} + \ldots + \alpha_0 x_n - h[\beta_k x'_{n+k} + \beta x'_{n+s} + \beta_{k-1} x'_{n+k-1} + \ldots + \beta_0 x'_n] \sim c_{p+1}(s) x_n^{(p+1)}$, a function of the real parameter s occurring in the theory of the numerical solution of initial-value problems by multistep methods, is considered. The errors of approximations to x_s and x'_s, for Hermite interpolation with equally spaced points, are found. Stability of the modified multistep operators with $\beta_k \neq 0$ and $\beta_k = 0$ is discussed, obtaining normalized families of operators of order p = 2k + 1 and p = 2k, respectively. Predictors are given for finding approximate values of x_{n+s}, x_{n+k}, in order to apply the general operator given above to the solution of the initial-value problems $x(a) = s$, $x' = f(t,x)$, $t \in I = [a,b]$. (M.J.T.)

28734 (RISÖ-88) ESTIMATION OF EXPERIMENTAL PARAMETERS. J. Thomas (Atomenergikommissionen, Risø (Denmark). Forsoegsinstitut). July 1964. 23p. Dep.(mn).

The problem of estimating the unknown parameters that determine the probability distribution of the observations in a physical experiment is discussed. The postulate by Bayes on equal a priori probabilities in case of no a priori knowledge is extended in order to avoid arbitrariness in

the choice of scale. This extended postulate is used on some simple examples involving the normal and the Poisson distributions. (auth)

28735 (TID-21546) AUTOMATIC PARAMETER SEARCH ON AN ANALOG COMPUTER. "Anita" Report No. 14. Karl M. Wiig (Christian Michelsens Institutt for Videnskap og Andsfrihet, Bergen (Norway)). Apr. 25, 1964. Contract [AT(30-1)-2607]. 30p. Dep.(mn); $2.00 (cy), 1(mn) CFSTI.

Parameter search — the problem of finding the values of parameters so as to fit a mathematical model to experimental data by means of recurrent solutions of the mathematical model with different parameter values — is an optimizing problem with a discrete strategy, where the performance criterion is a mathematical evaluation of the goodness of fit. The identification and instrumentation of such a strategy are discussed, including performance evaluation, control signal generator, and executive logic, and the strategy is applied to an actual parameter search problem. (M.J.T.)

28736 CONSIDERATIONS ABOUT PROGRAMMING MASS ADJUSTMENTS. W. Thiele (Max-Planck-Institut für Chemie, Mainz). p.82-90 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

The programming of an IBM 7090 computer to adjust atomic masses in accordance with improved data is discussed. (D.C.W.)

METALS, CERAMICS, AND OTHER MATERIALS

General

Refer also to abstracts 28926, 29468, and 29651.

28737 (BM-RI-6624) ELECTROREFINING URANIUM IN A CHLORIDE ELECTROLYTE. R. E. Campbell and T. A. Sullivan (Bureau of Mines, Boulder City, Nev. Boulder City Metallurgy Research Lab.). Sept. 1964. 17p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Uranium metal of improved purity was prepared by electrorefining commercial magnesium-reduced uranium in a molten sodium chloride–uranium trichloride electrolyte. The best operating conditions for the preparation of refined metal were established as follows: an electrolyte containing 8.7 to 13.3 weight-percent uranium; initial cathode current densities from 300 to 1,500 amp/sq ft; and a molten salt temperature of 860°C. Ingots produced from electrorefined uranium crystals prepared with these operating conditions were substantially free of metallic impurities. The only impurities in the refined and consolidated metal were present in low or undetectable amounts. (auth)

28738 (NP-15049) METHODS IN THE PREPARATION OF RADIOACTIVE MATERIAL (thesis). W. Parker (Chalmers Tekniska Hogskola, Goteborg (Sweden)). 1965. 92p. Dep.(mn).

Thirteen papers dealing with the preparation of radioactive samples for use in nuclear research are presented and arranged into four parts. Part I gives a brief description of those methods and techniques most frequently made use of at the present time and also describes the preparation of thin films and foils employed as support material for radioactive layers. Parts II and III, dealing with vacuum deposition and electrodeposition respectively, describe the application of these methods to the preparation of thin layers of radioactive material. In both instances, the highest possible transference or yield, from original form to sample, has been sought. Finally, in Part IV, the results of accumulated procedures are presented for the preparation of seventy elements. (auth)

28739 (RFP-545) MARASET EPOXY RESIN AND COORS PELLETIZED ALUMINA AS A METALLOGRAPHIC SPECIMEN POTTING COMPOUND. A. E. Calabra (Rocky Flats Div., Dow Chemical Co., Golden, Colo.). [Apr. 20, 1965]. Contract AT(29-1)-1106. 19p. (CONF-650414-2). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From 19th Metallographic Group Meeting, Oak Ridge, Tenn.

The addition of Coors pelletized alumina to Maraset epoxy resin as a metallographic specimen potting compound results in a mount having excellent abrasive resistant qualities and minimal mold shrinkage. Specimens of varying hardness can be readily prepared with excellent edge retention. (auth)

28740 (SGAE-CH-12/1964) DER PLASMABRENNER UND SEINE VERWENDUNG ZUM RUNDSCHMELZEN VERSCHIEDENER MATERIALIEN. (The Plasma Burner and Its Application to Round Melts of Various Materials). A. Strigl and H. Bildstein (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H.; Seibersdorf. Institut fuer Chemie). 1964. 23p. Dep.(mn).

A plasma melting installation was described that is suitable for the preparation of round fused particles from metals, oxides, and carbides. The various factors affecting the fusability were discussed, and results on melt studies were reported. (tr-auth)

28741 (SGAE-CH-15/1965) MOLECULAR PLATING. [PART] IV. A RAPID METHOD FOR THE ELECTRODEPOSITION OF PLUTONIUM. N. Getoff, H. Bildstein, H. Riedl, and H. Saukel (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Institut fuer Chemie). [1964]. 13p. Dep.(mn).

A method for rapid electrodeposition and preparation of extremely uniform films of plutonium is described, using isopropyl alcohol as solvent. In the presence of traces of alkali hydroxide, it is possible to deposit plutonium quantitatively at 600 v in a short time. The plutonium films obtained are very suitable for activity measurements by gas flow counting and α-spectroscopy. (auth)

28742 MEASUREMENT OF THE TIN COATING THICKNESS BY THE X-RAY FLUORESCENCE USING ^{3}H/Zr SOURCE. Tadewsh Florkowski and Jerzy Ostachowicz (Mining and Metallurgical Academy and Inst. of Nuclear Tech., Krakow). Nukleonika, 10: 11-18(1965) (In Polish)

Measurement of the tin coating thickness by the x-ray fluorescence excited by the ^{3}H/Zr source is described. Two methods of detection were used: the proportional counter and the x-ray GM-counter. For the thickness range of 1–4 microns the accuracy is 2 and 5%, respectively in the time 10–20 sec. Results were compared with other investigations in the field. (auth)

28743 A FAST AND CONVENIENT METHOD OF MEASURING THE THICKNESS OF TIN COATINGS ON STEEL SHEETS. Adam Jasinski, Jan Kownacki, and Henryk Lancman (Inst. of Nuclear Research, Warsaw). Nukleonika, 10: 57-9(1965).

Methods for measurement of the thickness of tin coating on steel sheets are usually based on the dependence of the intensity of scattered β rays on the atomic number Z of the scattered material. This intensity is approximately proportional to the atomic number of the material investigated. Attempts were made to apply the excited x-ray fluorescence to such measurements. In view of the fact that the intensity in this case is approximately proportional to Z^4, it is hoped that a method based on this phenomenon will be more sensitive than that mentioned above. (auth)

28744 THEORY OF MOLTEN ALKALI ALLOYS. I. Na–K SYSTEM. J. R. Christman (Rensselaer Polytechnic Inst., Troy, N. Y.) and H. B. Huntington. Phys. Rev., 139: A83-90(July 5, 1965).

A theory of liquid alkali-metal alloys is proposed which takes advantage of the absence of structure factors in the diagonal elements of the augmented plane-wave hamiltonian. The theory is used to calculate volume and compressibility deviations from ideal values for a 50-50 Na-K mixture, with the result that the calculated deviations are of the order of twice those found experimentally. The enthalpy of mixing also turns out too large. The sizes of the atomic cells for sodium and potassium tend to approach somewhat their average value on mixing. Also a small negative charge (~0.04e) is predicted to be transferred from the potassium to the sodium cell. (auth)

28745 EVALUATION OF ML-1 SECOND CORE FUEL-ELEMENT MATERIALS AFTER LONG TERM IN-REACTOR TESTING. J. S. Brunhouse and G. W. Titus (Aerojet-General Nucleonics, San Ramon, Calif.). Trans. Am. Nucl. Soc., 8: 43-4(May 1965).

28746 A COMPARISON OF BURNUP DATA FROM URANIUM CARBIDE DEVELOPMENT PROGRAMS WITH CONSEQUENCES OF HIGH-TEMPERATURE OPERATION. Carleton D. Bingham and Knox M. Broom, Jr. (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 8: 46-7(May 1965).

28747 OUT-OF-PILE STUDIES OF FISSION-PRODUCT RELEASE FROM COATED-PARTICLE FUELS. Harvey S. Rosenberg, David L. Morrison, Charles W.

Townley, and Duane N. Sunderman (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Nucl. Soc., 8: 47 (May 1965).

28748 AUTORADIOGRAPHIC DETERMINATION OF THE CONTACT POPULATION AT SURFACE JUNCTIONS. Henri Fenech, E. T. Foster, and L. J. Kazubinski (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nucl. Soc., 8: 80(May 1965).

28749 IMPROVEMENTS IN OR RELATING TO NUCLEAR FUEL MATERIALS. Ronald George Sowden, and Neville Hodge (to United Kingdom Atomic Energy Authority). British Patent 986,215. Mar. 17, 1965. Filed Dec. 21, 1962.

A method is described for the reduction of fuel dicarbides and sesquicarbides to the monocarbides by reacting the higher carbides with hydrogen at a temperature not less than 1000°C in the substantial absence of oxygen and water vapor. The reaction time is dependent on reaction temperature and on the material being treated. With uranium dicarbide and mixed uranium-plutonium carbides containing some higher carbides, a reaction time of at least 3 hours at a temperature of 1000°C is necessary. With plutonium sesquicarbide, at reaction temperature of 1000°C, a reaction time of not less than 6 hours is necessary. Satisfactory sintered densities are obtained if a mixture of uranium and plutonium monocarbides and sesquicarbides is sintered and reduced simultaneously for a period of at least 1 hour at a temperature of 1500°C in flowing hydrogen. (B.L.M.)

28750 IMPROVEMENTS IN AND RELATING TO THE SPHEROIDISING OF PARTICLES. John Jenkin Matthews and Brian Kevin Byrne (to Associated Electrical Industries Ltd.). British Patent 986,701. Mar. 24, 1965. Filed Oct. 4, 1962.

A method for spheroidising granular particles such as boron carbide or uranium oxide consists of arranging the particles in a container to form a bed through which a gaseous medium is passed so as to fluidize the bed. The bed is supported on a gas-permeable base of the container and two electrodes are insulatingly mounted in the bed to produce a locally heated region in the bed by a continuous or pulsed plasma discharge through the ionizable gas. Argon or nitrogen or suitable mixtures are used as the gaseous medium. The gas flow causes the particles to move in random manner into and through the locally heated zone to cause melting of the surfaces with progressive reduction to spheroidal form due to surface tension acting on their molten surfaces. The molten surface of the particles freezes in the cold zone of the bed. The plasma discharge is supplemented by resistive or other auxiliary heating, and the random motion of the particles is augmented by jets of gas injected into the bed. (B.L.M.)

28751 METHODS AND APPARATUS FOR THE PREPARATION OF GRANULAR PRODUCTS AND IN PARTICULAR OF URANIUM OXIDE. Maurice Delange, Henri Huet, and Paul Vertes (to Commissariat à l'Énergie Atomique). Canadian Patent 674,964. Nov. 26, 1963. Priority date May 18, 1960, France.

A method is described for the production of granular products particularly uranium oxides suitable for reduction or treatment with HF. A rotating horizontal drum partly immersed in a bath of a paste of ammonium uranate picks up a thin layer of the paste (thickness ranging from 2 to 4 mm) and deposits the paste in lumps on a moving conveyor belt. The small lumps contain 50 to 70% water and are heated to 150 to 250°C to form on the surface of the lumps a crust that will give each particle a suitable mechanical resistance during subsequent operations. The particles then are heated in an air or other gas oxidizing atmosphere at a temperature ranging from 350 to 450°C. Successive elements in the same furnace may be used to accomplish the operations. (B.L.M.)

28752 PROCESS OF FUSION ELECTROLYSIS FOR METAL PRODUCTION. Bernhard Berghaus and Marie Staesche (to Elektrophysikalische Anstalt Bernhard Berghaus). Canadian Patent 685,774. May 5, 1964. Priority date Sept. 7, 1959, Switzerland.

A process of fusion electrolysis for producing metals from fusible salts is described in which compounds consisting of ammonia and a metal halide are used as additives to improve the electrolyzing qualities of the fusible salt. The process is applicable to the production of the light metal Mg, Ti, Al, Be, and B and of the transition metals Zr, Th, and U. The metal in the additive compound must be the same as the metal to be produced, and the additive compound must be present in an amount of less than 10%. The temperature of the liquefied material is reduced by the additive substance, and at a given temperature the current passage through the liquefied material at a given electrolyzing voltage is increased by the additive substance. (B.L.M.)

28753 METHOD FOR PREPARATION OF GRANULATED THORIUM DIOXIDE OF A DEFINITE PARTICLE SIZE AND EXACT SPHERICAL SHAPE. Hans Simon Gerard Slooten (to Stichting Reactor Centrum Nederland). German Patent 1,185,596. Priority date Sept. 16, 1959, [Netherlands].

An emulsion containing 1 part by volume of a 4 molar thorium hydroxide sol in about 17 part by volume of a solvent immiscible with water is mixed with a solvent saturated with ammonia and insoluble in water. The spheres obtained by the gelation are separated by filtration. (Gmelin Inst.)

28754 METHOD FOR PREPARATION OF POWDERS OF URANIUM CARBIDE, URANIUM NITRIDE, OR URANIUM SILICIDE. Andre Accary, Jacques Dubuisson, and Pierre Rousset (to Commissariat à l'Énergie Atomique). German Patent 1,187,232. Feb. 18, 1965. Priority date Dec. 31, 1960, France.

An aggregation of metal-ceramic consisting of uranium and uranium compound is treated with an agent like hydrogen or hydrochloric acid which reacts with the uranium so that the aggregation disintegrates. The powdery uranium compound is separated from the mixture obtained. (Gmelin Inst.)

Corrosion

Refer also to abstract 28414.

28755 (ORNL-3823) SNAP-8 CORROSION PROGRAM QUARTERLY PROGRESS REPORT FOR PERIOD ENDING FEBRUARY 28, 1965. H. W. Savage, E. L. Compere, R. E. MacPherson, W. R. Huntley, and A. Taboada (Oak Ridge National Lab., Tenn.). June 1965. Contract W-7405-eng-26. 43p. Dep.; $3.00(cy), 1(mn) CFSTI.

Results of analytical examinations of corrosion loops confirmed that very little metal migration occurred in low-oxygen-content NaK at both temperature levels investigated; however, carbon migration was quite severe. Corrosion of the iron-base alloys in the low-oxygen-content NaK was very low, as compared with corrosion of the chromized Hastelloy N. Increasing the oxygen content of the NaK accelerated the corrosion rate on all materials. High corrosion rates were observed in some loops run with low oxide content. The results observed would be consistent with a hypothesis that intermittent high oxide situations in an otherwise low oxide regime are as damaging as continuous high oxide contents. Additions of hydrogen to the NaK did not produce any discernible effects on the mass transfer rates. Nor was the extent of carbon migration apparently affected by hydrogen or oxygen levels in the NaK. Because of the extensive decarburization of Croloy 9M in the SNAP-8 corrosion loops, a study was made for determining the effects of decarburization on selected mechanical properties. Sheet tensile specimens were decarburized to a carbon content of approximately 0.002 to 0.01% by exposure to NaK in a forced-flow type 316 stainless steel loop. A general deterioration of mechanical properties was observed. Studies were con-

ducted of the permeation of hydrogen and deuterium through type 316 stainless steel in the presence of NaK. The ratio of permeability of deuterium and hydrogen was 0.68 at 1100°F and 0.74 at 1300°F. Hydrogen solubilities in NaK-78 were determined for a temperature range of 572 to 1300°F as a function of hydrogen pressure from a few millimeters to 1 atm, and Sievert's law was found to hold for this system. Evidence of solid hydride precipitation was observed below 752°F. Studies of the phase equilibria of the Na–K–Li–H system at 1100°F indicate that in all cases examined the addition of lithium greatly lowers the partial pressure of hydrogen at equivalent hydrogen concentrations. This is apparently due to the hydrogen combining with the respective alkali metals in proportion to their concentration and affinity for hydrogen. The limited solubility of lithium hydride results in precipitation, which inhibits pressure changes until the available lithium is exhausted. (W.L.G.)

28756 (ORNL-TM-1029) LABORATORY CORROSION STUDIES FOR THE HIGH FLUX ISOTOPE REACTOR. J. L. English and J. C. Griess (Oak Ridge National Lab., Tenn.). June 1965. Contract W-7405-eng-26. 40p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

The results of a two-year laboratory study to examine the corrosion behavior of materials of interest for the High Flux Isotope Reactor are presented. The environment consisted of quiescent pH 5.0 water at temperatures of 100°C and below. In most cases, the emphasis was on long-term behavior. The presence of 0.8 ppm of copper was found to cause a fourfold increase in the pitting frequency of 6061-T6 aluminum. When contacted by stainless steel and related materials, 6061 aluminum was subject to substantial pitting attack on contact surfaces. The deepest penetration was 42 mils after 14,000 hr of contact with type 410 stainless steel. The susceptibility to pitting was independent of whether the aluminum alloy was in the -T6 or -0 condition. Type 1100 aluminum was also subject to pitting when contacted by either Teflon or Celcon plastics. Types 302, 303, 304, 316, and 17-4 PH stainless steel exhibited excellent resistance with corrosion rates less than 0.1 mpy. Sensitized type 304L stainless steel with a carbon content of 0.04% showed no signs of intergranular penetration after 13,500 hr of exposure. Nitrided types 304 and 17-4 PH stainless steel were unsatisfactory with evidence of blistering. Two alloys, GE-81 and AMS-4775, appeared the most corrosion resistant of five different brazing alloys that were tested. Chemloy 70719, Fluorogreen, Rulon A, and carbon-filled Teflon were completely resistant at 50° and 100°C. Celcon and Delrin showed good behavior at 50°C but underwent degradation at 100°C. Alnico V behaved poorly at 50° and 100°C with appreciable scaling and pitting. Defected aluminum-clad rare earth compacts were severely swelled, blistered, and exfoliated at 100°C whereas the behavior of an aluminum-tantalum dispersion was excellent. (auth)

28757 (FTD-TT-64-1154) STUDYING THE OXIDATION KINETICS AND STRUCTURE OF OXIDES OF CERTAIN HIGH-MELTING METALS. P. M. Arzhaniy (Arzhanyy), R. M. Volkova, and D. A. Prokoshkin. Translated from Issled. po Zharoproch. Splavam, Akad. Nauk SSSR, Inst. Met., 9: 172-7(1962). 13p. CFSTI.

Kinetic studies of the oxidation of Nb, W, Nb–Si, W–Si, and Nb–Si–Ti systems were performed. The binary and ternary samples were prepared by exposing the Nb and W to Si and Ti for 6 hrs at 1200°C. Linear oxidation rates were obtained for Nb and parabolic rates for Nb–Si and Nb–Si–Ti. Complex rates were obtained for the oxidation of W and W–Si; both evidenced deviations from one type rate to the other. The oxide films were examined and their composition and crystal structures identified. (W.L.G.)

28758 ELECTROCHEMICAL MEASUREMENTS ON ZIRCONIUM AND ZIRCALOY-2 AT ELEVATED TEMPERATURES. II. 200°-300°C. A. L. Barcarella and A. L. Sutton (Oak Ridge National Lab., Tenn.). J. Electrochem. Soc., 112: 546-53(June 1965). (ORNL-P-637)

Rates of film growth in oxygenated dilute sulfuric acid were measured on zirconium and Zircaloy-2 at temperatures from 200 to 300°C using electrochemical methods. The resulting rate-time plots were analyzed according to logarithmic and cubic kinetics. The kinetic constants obtained from these results, and those of other investigators, were correlated with respect to temperature. The calculated activation energy for the cubic rate constant was 29.7 kcal/mole. The reduction of oxygen was studied as a function of film thickness. The results showed two polarization regions, a high current region with a Tafel slope about 3 to 5 (2.3 RT/F) and a low current region with a Tafel slope decreasing with film thickness from 4 (2.3 RT/F) to 1.4 (2.3 RT/F). The oxygen evolution reaction was also studied at 295°C. The observed Tafel slope ranged between 0.8 to 1.0 (2.3 RT/F). The anodic process in the over-all corrosion reaction was postulated to be a field-dependent ionic transport of oxygen ions. The Tafel slope for this process increased with film thickness from 4 (2.3 RT/F) to 16 (2.3 RT/F). At 295°C, a steady-state anodic rate independent of potential was observed. This result suggested that at steady-state the film dissolution rate is equal to the rate of film formation. The weak-field approximation to the conventional anodizing equation was postulated for the film formation reaction. The film dissolution reaction was not postulated. (auth)

28759 THE REACTION OF ZIRCONIUM WITH CARBON DIOXIDE AND CARBON MONOXIDE AT 850°C. R. J. Hussey and W. W. Smeltzer (McMaster Univ., Hamilton, Ont.). J. Electrochem. Soc., 112: 554-60(June 1965).

An investigation was made of the kinetics, the chemistry, and the solid-state processes for the reaction of zirconium with carbon dioxide and carbon monoxide at 850°C. In carbon dioxide at 10 cm Hg pressure, the kinetic curve showed an initial decreasing rate, an intermediate increasing rate, and a final decreasing rate. The ratio of carbon to oxygen uptake by zirconium in carbon dioxide was dependent on time and varied from 0.19 to 0.04 over a period 1 to 48 hr. Carbon produced in the early stages of reaction was incorporated into the oxide and led to formation of a needle-like phase of a ternary lower oxide or a solid solution at the metal/oxide interface. Due to a high ratio of carbon to oxygen uptake in carbon monoxide, this phase developed to a distinct intermediate layer between the oxide scale and metal substrate. The kinetic curves in this gas exhibited a continuously decreasing oxidation rate; eventua ly breakaway occurred, possibly due to the presence of the secondary phase at the metal-oxide interface. In the range of parabolic oxidation for both carbon dioxide and carbon monoxide, the rates were similar in magnitude to that found in oxygen. Comparison of oxygen gradients demonstrated that the extent of oxygen solution in the metal was the same for oxidation in these gases. (auth)

28760 HIGH-TEMPERATURE OXIDATION. II. MOLYBDENUM SILICIDES. Joan B. Berkowitz-Mattuck (Arthur D. Little, Inc., Cambridge, Mass.) and R. R. Dils. J. Electrochem. Soc., 112: 583-9(June 1965).

The oxidation of $MoSi_2$, Mo_5Si_3, and Mo_3Si was studied at temperatures of 1300 to 2000°K, and at oxygen partial pressures of 2 to 20 torr. Below 1970°K, at oxygen pressures around 10 torr, measurements of the rate of total oxygen consumption vs. time showed an initial period of high linear rate, an intermediate region where the rate declined sharply with time, and a final plateau region of virtually zero oxidation rate. For each of the silicides, the total oxygen consumed prior to the attainment of the plateau decreased with temperature, and under given experimental conditions was largest for Mo_3Si, less by a factor of about six for Mo_5Si_3, and less by another factor of six for $MoSi_2$. The oxidized samples displayed a smooth glassy outer oxide layer that bridged across the tops of the cracks in the alloys and an inner oxidized zone, consisting of several irregular phases. Electron microprobe analysis and x-ray photomicrographs of the oxidized specimens showed that the outer protective oxide is pure SiO_2, within the limits of detectability, i.e., the outer oxide contains less than 0.1% Mo. The inner oxide layer contained SiO_2, molybdenum rich phases, including the terminal

solid solution phase, and the original alloy phase. Evidence is presented that suggests that the oxide layers grow by inward diffusion of oxygen to the oxide/alloy interface where preferential oxidation of silicon occurs. The excellent oxidation resistance of the molybdenum silicides derived from the formation of this continuous layer of pure silica. Above 1970°K, at oxygen pressures above 10 torr, an increased oxidation rate was observed due to formation of SiO(g) at the alloy/oxide interface, which caused rupture of the protective oxide. Below 1970°K, at oxygen pressures near 2 torr, the rate of oxidation of $MoSi_2$ was linear at all times since the oxygen partial pressure was insufficient to maintain a protective SiO_2 layer on the alloy surface. (auth)

28761 CORROSION-RESISTANT, BORON-CONTAINING STEEL FOR NUCLEAR REACTORS. E. S. Levinzon. Stal, 22: 648-9(1962). (In Russian)

A corrosion-resistant steel containing 22%Cr, 10%Ni, and 1.2%B was developed as a construction material for nuclear reactors. The steel had a yield point of 48.5 to 51.0 kg/mm^2, tensile strength of 86.2 to 86.5 kg/mm^2, and impact resistance of 3.1 to 3.3 kg/cm^2 at 29°C and 2.2 to 2.4 kg/cm^2 at −75°C. (M.C.G.)

28762 HIGH-TEMPERATURE CENTRIFUGE FOR NIOBIUM AND TANTALUM SOLUBILITY IN POTASSIUM. Robert J. Teitel (Douglas Aircraft Co., Inc., Santa Monica, Calif.). Trans. Am. Nucl. Soc., 8: 15(May 1965).

28763 STRESS CORROSION OF Nb-Zr ALLOYS IN Hg. A. H. Fleitman, A. J. Romano, and C. J. Klamut (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 8: 15-16(May 1965).

28764 THE CORROSION OF REFRACTORY METALS AND THEIR ALLOYS BY SODIUM LIQUID AND VAPOR AT TEMPERATURES UP TO 1260°C. A. J. Romano, A. H. Fleitman, and C. J. Klamut (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 8: 16(May 1965).

28765 EFFECT OF SURFACE TREATMENT ON ZIRCALOY-CLAD FUEL RODS IN A CHEMICAL-SHIM ENVIRONMENT. D. R. McClintock (Westinghouse Electric Co., Pittsburgh). Trans. Am. Nucl. Soc., 8: 17(May 1965).

28766 CORROSION OF REFRACTORY METALS IN CESIUM AND LITHIUM ABOVE 2500°C. J. A. De Mastry and N. M. Griesenauer (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Nucl. Soc., 8: 17-18(May 1965).

28767 ULTRASONIC-INDUCED CAVITATION IN LIQUID METALS AT 1500°F. R. Garcia and F. G. Hammitt (Univ. of Michigan, Ann Arbor). Trans. Am. Nucl. Soc., 8: 18-19(May 1965).

28768 A NEW TECHNIQUE FOR TESTING MOLTEN PLUTONIUM CONTAINER MATERIALS AT HIGH TEMPERATURE. R. L. Andelin, A. R. Hawkins, and N. G. Wilson (Los Alamos Scientific Lab., N. Mex.). Trans. Am. Nucl. Soc., 8: 19-20(May 1965).

28769 CORROSION CONSIDERATIONS—SUPERHEAT FUEL-CLADDING MATERIALS. W. L. Pearl, E. G. Brush, G. G. Gaul, and G. P. Wozadlo (General Electric Co., Pleasanton, Calif.). Trans. Am. Nucl. Soc., 8: 122(May 1965).

28770 STUDIES OF CLADDING MATERIALS FOR THE MARVIKEN SUPERHEATER ELEMENTS. G. Oestberg, L. Unneberg, M. de Pourbaix, S. Jansson, W. Huebner, and L. Hammar (Aktiebolaget Atomenergi, Stockholm). Trans. Am. Nucl. Soc., 8: 122-3(May 1965).

28771 METAL-STEAM REACTIONS AT HIGH TEMPERATURES. R. E. Wilson and C. Barnes, Jr. (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 306-7 (May 1965).

28772 METHOD OF TREATING POWDERED URANIUM DIOXIDE TO PREVENT A SPONTANEOUS OXIDATION OF THE ARRANGEMENT IN AIR. Yvette Carteret, Pierre Chenebault, and Roger Delmas (to Commissariat à l'Énergie Atomique). German Patent 1,183,061. Dec. 10, 1964. Priority date July 18, 1960, France.

The powder is exposed to a gaseous or vaporous inhibitor. The ratio of the equilibrium pressure of the inhibitor to the maximum pressure of the inhibitor is between 0.05 and 1 when at least a monomolecular layer of the inhibitor is obtained by adsorption on each of the powder grains. (Gmelin Inst.)

Fabrication

Refer also to abstracts 28483, 29614, and 29707.

28773 (BMI-X-10096) SUMMARY REPORT ON THE FABRICATION OF PROJECTIONS ON ZIRCALOY TUBES. D. C. Drennen and R. E. Monroe (Battelle Memorial Inst., Columbus, Ohio). Aug. 4, 1964. For Bettis Atomic Power Lab., Pittsburgh, Pa. Contract W-7405-eng-92, Subcontract 73-14-1193. 46p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

The capability of a process, termed resistance gathering to form localized projections on 1-inch-OD Zircaloy-4 cladding tubes was demonstrated. It was shown that the corrosion resistance of tubes containing projections was not impaired when argon shielding was used during the forming process. Procedures to fabricate projections on smaller tubes were not developed. (auth)

28774 (CRE-1139) DIFFUSIONLESS BONDING OF ALUMINUM TO ZIRCALOY-2. R. D. Watson (Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Project). Dec. 1962. Re-issued Apr. 1965. 21p. (AECL-2243). $0.50(AECL).

Aluminum can be bonded to Zircaloy-2 without difficulty even when a thin layer of oxide is present on the surface of the Zircaloy-2. No detectable diffusion takes place during the bonding process. The bond layer can be stretched as much as 8% without affecting the bond. The bond can be heated for 1000 hours at 260°C (500°F), and can be water quenched from 260°C (500°F) without any noticeable change in the bond strength. An extrusion technique was devised for making transition sections of aluminum bonded to Zircaloy-2 which can then be used to join these metals by conventional welding. Welding can be done close to the bond zone without seriously affecting the integrity of the bond. (W.L.G.)

28775 (CRE-1195) EFFECT OF THE ALUMINUM FLOW PATTERN ON THE BONDING OF ALUMINUM TO OXIDIZED ZIRCALOY-2. R. D. Watson and J. P. Lamber (Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.). Jan. 1964. 15p. (AECL-2244). Dep.; $0.50(AECL).

The bonds produced when hot aluminum is allowed to flow smoothly from an extrusion die to the oxidized surface of a heated tube of Zircaloy-2 are consistently inferior to those produced with back-extruded flow. The difference is believed to be due to the reduction in, or elimination of, the oxide layer on the aluminum that comes in contact with the surface of the Zircaloy-2. (auth)

28776 (DMIC-213) METAL REMOVAL BY ELECTROCHEMICAL METHODS AND ITS EFFECTS ON MECHANICAL PROPERTIES OF METALS. John A. Gurklis (Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio). Jan. 7, 1965. Contract AF33(615)-1121. 36p. (AD-613261). $2.00(CFSTI).

Information was assembled and correlated on the effects of electrochemical metal-removal (ECMR) processes on mechanical properties. Of special interest and concern were the effects of ECMR on fatigue strength. Four ECMR processes: electrochemical machining (ECM), electrolytic grinding (EG), electrochemical milling, and electropolishing are covered. General characteristics and applications of the four methods are presented and discussed; special emphasis is placed on ECM. The ECMR processes are especially useful in shaping high-strength and difficult-to-

machine metals and alloys, as well as in shaping parts with unusual, complex, or fragile characteristics. (auth)

28777 (FD-127) FABRICATION OF SINTERED UO_2 PELLETS WITH CONTROLLED BORON CONTENT. E. Mizzan and R. Stack (Atomic Energy of Canada Ltd., Chalk River (Ontario)). July 1964. Reprinted Feb. 1965. 14p. (AECL-2204). Dep.; $0.50(AECL).

Sintered UO_2 pellets containing 40, 80 and 120 ppm boron were fabricated by sintering in argon at 1325°C followed by reduction in hydrogen at the same temperature and hydrogen cooling. Over 85% of the boron added was retained in the sintered pellets and the standard deviation of the boron content from pellet to pellet was ±0.6%. (auth)

28778 (UCRL-7841) HYDROSTATIC COMPACTING. Frank H. Miars (Lawrence Radiation Lab., Univ. of California, Livermore). Apr. 23, 1964. Contract W-7405-eng-48. 13p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

The process of hydrostatic compacting of materials is described briefly. The equipment involved in the process is discussed. A 50,000-psi and a 150,000-psi compacting system are described in some detail. (D.L.C.)

28779 (AEC-tr-6519) FABRICATION OF URANIUM. INFLUENCE OF FABRICATION OF THE MICROSTRUCTURE AND MECHANICAL CHARACTERISTICS OF URANIUM AND OF SLIGHTLY ALLOYED URANIUM. J. Stohr (Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). Translated from a Publication of the Commissariat a l'Energie Atomique, Saclay. [1962]. 42p. Dep.(mn); $4.60(fs), $1.46(mf) JCL.

The effects of various fabrication procedures on the microstructure and mechanical properties of technically pure or lightly alloyed Al–Fe–U and Mo–U alloys were investigated. The fabrication procedures included: casting into hot or cold molds by gravity, centrifuging, and injection under pressure; and, plastic deformation by drawing in the α- and γ-phases and rolling in the γ-phase. Some samples were subjected to heat treatments. No fabrication method yielded the desired microstructure, small grain size and absence of preferred orientation, without subsequent heat treatments nor was any important difference in mechanical properties noted. (W.L.G.)

28780 PRELIMINARY REMARKS ON THE MANUFACTURING OF FUEL PELLETS FROM BERYLLIUM, THORIUM, AND SOLID SOLUTIONS OF URANIUM–THORIUM. Clauer Trench de Freitas, Heliton Motta Haydt, and Tharcisio D. de Souza Santos (Instituto de Energia Atomica, Sao Paulo, Brazil). ABM(Bol. Assoc. Brasil. Metals) (Sao Paulo), 20: 557-66(1964). (In Spanish)

The principal experimental data obtained in studies of BeO, ThO_2, and ThO_2–UO_2 production are described. Annular pieces of BeO were produced for use in neutron sources. The ThO_2 and ThO_2–UO_2 pellets were for use in studies related to the utilization of thorium in reactors. (auth)

28781 PRELIMINARY REMARKS ON PROPERTIES AND STRUCTURES OF POWDER DISPERSIONS OF U_3O_8–Al. Richard M. Bidwell, Heliton M. Haydt, Clauer Trench de Freitas, and Tharcisio D. de Souza Santos (Instituto de Energia Atomica, Sao Paulo, Brazil). ABM (Bol. Assoc. Brasil. Metals) (Sao Paulo), 20: 567-76(1964). (In Spanish)

Work related to the production of natural U_3O_8 and aluminum powder dispersions of different grain sizes and to the micrographic structures obtained in the mechanically worked cores, with the dimensions of the transversal section approximating the ones desired for fuel elements is described. The results show a homogeneous distribution and a perfect physical continuity between the core containing the dispersion and the cladding material, a 2S aluminum alloy. (auth)

28782 DIMENSIONAL CONTROL OF URANIUM FUEL PELLETS FOR RE-SUCO REACTOR. Paulo Sergio C. Pereira da Silva, Tharcisio D. de Souza Santos, and Clauer Trench de Freitas (Instituto de Energia Atomica, Sao Paulo, Brazil). ABM(Bol. Assoc. Brasil. Metals) (Sao Paulo), 20: 759-70(1964). (In Spanish)

The principles of dimensional control of UO_2 pellets for reactor fuel elements and their use in the "Re-Suco" subcritical reactor were studied. The expressions that relate the principal actual variables were established based on the definition of the "sintering ratio." This concept permits the selection of the most convenient flowsheet from the standpoint of capital investment and fabrication cost, simplifying the quality control during the pellet fabrication. The ranges of permissible deviation of the values of the principal geometrical and physical characteristics to satisfy the design features of the reactor are indicated. (auth)

28783 EXPERIMENTAL STUDIES OF THE PRINCIPAL VARIABLES IN THE PRODUCTION OF UO_2 PELLETS FOR SUB-CRITICAL RE-SUCO REACTOR. Tharcisio D. de Souza Santos, Richard M. Bidwell, Clauer Trench de Freitas, Heliton M. Haydt, and Paulo Sergio C. Pereira da Silva (Instituto de Energia Atomica, Sao Paulo, Brazil). ABM(Bol. Assoc. Brasil. Metals) (Sao Paulo), 20: 771-84 (1964). (In Spanish)

A program of experimental studies was carried out in order to determine the influence of the principal variables related to the production of about 5000 UO_2 pellets of 40 mm in diameter to be used at the "Re-Suco" subcritical reactor. Results are presented related to (1) calcining temperature of ammonium diuranate; (2) reduction time and temperature in H_2 of both ammonium diuranate and U_3O_8 produced at different temperatures; (3) milling conditions of stoichiometric UO_2; (4) relation between the density of the powders and their compactability; (5) influence of binders on the compactability; (6) pre-pressing, including the influence of the pre-pressing pressure; (7) sintering variables: time and temperature; and (8) determination of the maximum safe rates during heating and cooling of the pellets. (auth)

28784 PRODUCTION OF NUCLEAR FUELS. PART I. NATURAL URANIUM. F. Ploeger and H. Vietzke (Nuklear-Chemie und -Metallurgie GmbH, Wolfgang, Ger.). Chem.-Ingr.-Tech., 37: 1-7(Jan. 1965). (In German)

The uranium was extracted from the pulverized ore with sulfuric acid as the uranyl ion and separated by ion exchange and solvent extraction from the accompanying elements. From this solution the uranium concentrate was precipitated and purified by liquid-liquid extraction with TBP. The uranium was then precipitated as the oxide, which could be used directly as fuel, or was reduced to metal (after fluorination), or converted into the carbide with graphite powder. (tr-auth)

28785 HIGH-FREQUENCY INDUCTION HEAT TREATMENT OF METALLIC URANIUM. K. Kawashima. FAPIG(Tokyo), No. 29, 276-82(Dec. 1963). (In Japanese)

Hot-worked metallic uranium elements have a structure consisting of fine crystals with an excessively preferred orientation, while the cast elements have large crystal grains oriented randomly. The occurrence of undesirable radiation damages to a uranium fuel element is minimized when the element is composed of randomly oriented and finely divided crystal grains. In the temperature range of 662 to 774°C uranium is of the β-phase. The so-called β-treatment, which involves quenching or transformation of the β-phase to the α-phase, is known as an effective procedure to improve the structure of the element in the orientation and grain size. Tests were conducted on the β-treatment of a uranium bar, in a testing apparatus. The testing apparatus consisted of a high-frequency generator, a high-frequency output controlling gear, a transformer, high-frequency quenching device, and a device for temperature measurement and recording. The results of these tests are as follows: (1) a solid cylindrical uranium bar of OD 42 mm and ID 23 mm can be β-treated effectively in the apparatus using 3000 cycles per second. (2) The heating obtained by the high-frequency induction heating is uniform after thermal equilibrium is attained and so long elements can be treated. (3) The high-frequency induction heating is effective in the satisfactory β-treatment. (4) The structure of an element after β-treatment by the high-frequency induction heating is more fine and homogeneous than

that obtained by the conventional β-treatment using a salt bath. (CSFTI)

28786 PLATING OF AND ON URANIUM. H. Geduld. Prod. Finishing (Cincinnati), 18: 62-3; 66(Jan. 1965).

Investigations on the subject are briefly reviewed and some of the procedures developed are described. Zinc was electrodeposited on uranium from an anhydrous bath containing 200 g zinc acetate (anhydrous), 250 g potassium acetate (anhydrous) and 1000 ml of 99% formamide. Periodic reverse current was used with 20 seconds plate and 10 seconds deplate. The temperature was 25 to 45°C and a current density of 0.3 to 0.5 amp/dm^2 was employed. The adhesion of the zinc deposit to the uranium substrate was considerably influenced by the pre-plate cleaning procedures used, the best results being obtained by anodic etching for five minutes at 5 amp/dm^2 in a solution of hydrogen chloride gas in formamide. (CFSTI)

28787 SINTERING OF CERAMICS FROM UO_2. I. PREPARATION OF UO_2 SINTERABLE AT RELATIVELY LOW TEMPERATURES. D. Jakes, L. Sedlakova, and J. Wolf (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Prague). Silikaty, 8: 273-82(1964). (In Czech)

Methods for preparing UO_2 with high surface area are described. Surface areas of these UO_2 specimens prepared were mainly influenced by the temperature, concentration of the solution from which ammonium polyurante was precipitated, pH of the final suspension, and the H_2 reduction temperature. Drying temperature up to 200°C and the rate of precipitation influenced only a little the surface area of final UO_2. A maximum on the curve of the dependence of UO_2 surface area on the temperature of reduction at short exposures was found. In comparison with the reduction in H_2 atmosphere, reduction in CO atmosphere yielded UO_2 of slightly different surface area values. (auth)

28788 A METHOD FOR PREPARING DENSE SPHERICAL PARTICLES OF THORIUM AND URANIUM DICARBIDES. R. L. Pilloton and R. L. Hamner (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 48(May 1965).

28789 CURIUM OXIDE FABRICATION AND STABILITY. G. R. Cole, P. K. Smith, E. F. Sturcken, and M. C. Thompson (E. I. du Pont de Nemours and Co., Inc., Aiken, South Carolina). Trans. Am. Nucl. Soc., 8: 49 (May 1965).

28790 THE DEVELOPMENT OF AN IMPROVED COATING FURNACE FOR NUCLEAR FUEL PARTICLES. R. L. Pilloton, H. G. Flamm, and A. L. Lotts (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 49-50 (May 1965).

28791 HIGH-Pu-CONTENT Pu–Al FUEL PLATES. M. J. Zambernard (Nuclear Materials and Equipment Corp., Apollo, Pa.). Trans. Am. Nucl. Soc., 8: 50(May 1965).

28792 FABRICATION OF URANIUM TUBES FOR FUEL CORES. Herbert Davis, John F. MacNeill, Ralph J. Jansen, Jack S. Simonds (National Lead Co. of Ohio, Cincinnati). Trans. Am. Nucl. Soc., 8: 50-1(May 1965).

28793 IMPROVEMENTS IN OR RELATING TO THE MANUFACTURE OF THERMOELECTRIC DEVICES. Raymond William Dudding (to General Electric Co. Ltd.). British Patent 986,112. Mar. 17, 1965. Filed Apr. 5, 1961.

A method is provided for manufacturing thermoelectric devices in which elements of bismuth telluride or other semiconductor material are assembled in a rotatable mold providing rows of cells or pockets in which the elements are located. The electrical connections between the elements to provide hot and cold junctions are formed by introducing molten metal to the mold that is rotated so as to cast the connections onto the elements. The connections are conveniently cast out of tin or other relatively low-melting metals or alloys, which permit the casting to be carried out at a temperature that will not damage the elements or the mold. The thermoelectric devices are suitable for use in thermoelectric generators or thermoelectric refrigerators. (B.L.M.)

28794 IMPROVEMENTS IN AND RELATING TO COMPOSITES. (to Union Carbide Corp.). British Patent 986,179. Mar. 17, 1965. Priority date June 18, 1962, United States.

A process is reported for the preparation of impermeable, machinable, oxidation-resistant refractory composites, which will acquire a self-healing protective coating when exposed to oxidizing atmospheres. The graphite and one or more other material are combined in the "semi-alloyed" state throughout the composite. A mixture is formed of 100 parts of finely divided carbonaceous material and 10 to 100 parts of B or a mixture of B and Si or just B with Zr, Hf, Nb, and/or Ti. The resulting mixture is heated to at least 1800°C under a pressure of at least 2500 psi to form the refractory composite. (B.L.M.)

28795 METHOD OF MAKING DENSE REFRACTORY OBJECTS. William Dallas Anderson, William Otis Brandt, Jarvis Jerome Fargo, and Leon Joseph LeClercq (to Gladding, McBean and Co.). British Patent 987,786. Mar. 31, 1965. Filed Sept. 21, 1961.

A method is described for making dense, dimensionally accurate refractory objects composed essentially of refractory oxides of the group consisting of alumina, magnesia, titania, or zirconia in which the firing shrinkage is reduced. The finished article has a density in excess of 92% of the density of the pure refractory oxide employed in its manufacture. The method includes the steps of forming a deposit of the finely divided refractory oxide with a small amount of resinous material upon a rigid, non-absorptive mandrel; enclosing the deposited material with a compliant impervious envelope; subjecting the deposited material to the action of a vacuum to remove virtually all the volatile material; and then subjecting the encapsulated deposited material to a uniformly applied pressure. After the application of the pressure has compacted and oriented the refractory oxides, the deposited material is removed from the mandrel and subjected to firing at a temperature adapted to sinter and mature the material. (B.L.M.)

28796 IMPROVEMENTS IN OR RELATING TO SWAGING OR DRAWING APPARATUS. Roy Causer (to United Kingdom Atomic Energy Authority). British Patent 987,988. Mar. 31, 1965. Filed May 29, 1961.

A swaging apparatus suitable for carrying out production runs of swaged tubing includes a multiplicity of drawing heads of the planetary ball die kind arranged in tandem as drawing heads of decreasing diameter. Each end head includes a plurality of balls, an internally coned outer race for the balls, a cage for the balls, and two axially movable sleeves. One sleeve is in abutment with the balls, and the second sleeve is resiliently urged in contact with the balls in diametrical opposition to the first sleeve. The ring of balls associated with the race constitute an annular contact ball bearing. Means are provided for rotating and driving the outer race. Each intermediate head has a fixed-diameter outer race. (B.L.M.)

28797 COMPOSITION OF MATTER FOR SLOWING DOWN AND REFLECTING NEUTRONS, AND PROCESS OF MAKING SAME. Herbert Greiner. Canadian Patent 675,141. Dec. 3, 1963. Filed Oct. 8, 1957.

A process is described for making moderator and reflector masses and molded bodies of crystalline flaky graphite of a high degree of purity. The masses and bodies have a high density, thus, rendering them suitable for use in reactors. The premolded body is formed by arranging the crystalline graphite flakes in parallel layers and compressing the flakes in a direction perpendicular to the layers. The premolded body is then subjected to a pressure of 3000 to 5000 Kg/cm^2 in the same direction as the flake layers to cause the graphite flakes to weld together. The

graphite also may be mixed with a volatile liquid, and the resulting paste extruded to form the desired shape. The object is then heated to evaporate the liquid and finally subjected to pressure. A liquid or gaseous filler material may be mixed with the graphite prior to the formation of the premolded body. (B.L.M.)

28798 PROCESSES FOR SHEATHING THE FUEL ELEMENTS OF NUCLEAR REACTORS. Claude Beernaert (to Commissariat à l'Énergie Atomique). Canadian Patent 690,964. July 21, 1964. Priority date May 11, 1959, France.

In the process for sheathing fuel element rods, the various rods that are adapted to constitute an element are located between two sheet metal plates. A removable deformable armature is placed between the plates so as to allow lateral displacement in various rods while retaining their respective positions. The two metal plates are applied against the rods by plastic deformation and without changing the thickness of the surface area of the plates and without deformation of the armature. The deformable armature is removed after the forming of the ends of the element. The deformation process may be carried out with mandrels, which are removed after forming the sheath, in place of fuel rods. (B.L.M.)

28799 METHODS AND APPARATUS FOR SHEATHING. Maurice Gauthron and Claude Beernaert (to Commissariat à l'Énergie Atomique). Canadian Patent 692,225. Aug. 11, 1964. Priority date Dec. 19, 1957, France.

A method for sheathing fuel elements is characterized by the deformation and drawing of the sheath without deformation of the element. The sheath is applied to the element by heat and pressure by passage through a drawplate of suitable diameter. Means for heating the sheath and element are located in the drawplate. The sheathing operation is carried out under a controlled atmosphere or in a vacuum, and a liquid or a solid is introduced between the sheath and element to act as an intermediary of diffusion or to break oxide layers that may be present. (B.L.M.)

28800 METHOD AND APPARATUS FOR MAKING DENSE BODIES OF REFRACTORY MATERIALS. Massoud T. Simnad (to U. S. Atomic Energy Commission). U. S. Patent 3,182,102. May 4, 1965.

A method is given for making dense nuclear fuel elements. Fuel particles dispersed in graphite are placed in a thin-walled cylindrical metal jacket. High amperage electric current is passed through the cylindrical jacket and contents until temperatures of 1800 to 2300°C are attained. Simultaneously with the heating, 4,000-10,000 psi pressure is applied and the graphite is fused into a strong and very dense body. (AEC)

28801 A PROCESS OF MAKING CRUCIBLES. Zbigniew D. Jastrzebski (to U. S. Atomic Energy Commission). U. S. Patent 3,188,231. June 8, 1965.

Material consisting of a fired beryllium oxide–calcium aluminate mixture (85-92%: 8-15%) coated with a fired layer of an alumina-magnesia-beryllia (or calcium oxide) mixture is described for making crucibles. (AEC)

28802 BINARY NICKEL BASE ALLOYS. V. P. Calkins, E. S. Funston, and J. A. McGurty (to U. S. Atomic Energy Commission). U. S. Patent 3,189,445. June 15, 1965.

Fabrication of binary alloys containing nickel and 5 to 25% by weight samarium, europium, or gadolinium into control rods for use in neutronic reactor is described. (AEC)

28803 TERNARY NICKEL BASE ALLOYS. V. P. Calkins, E. S. Funston, and J. A. McGurty (to U. S. Atomic Energy Commission). U. S. Patent 3,189,446. June 15, 1965.

The fabrication of oxidation resistant ternary alloys containing four parts nickel per part of chromium and from 5 to 25% by weight samarium, europium, or gadolinium into control rods for use in neutronic reactors is described. (AEC)

28804 METALLIZING PROCESS FOR CERAMICS. Robert E. Cowan (to U. S. Atomic Energy Commission). U. S. Patent 3,189,476. June 15, 1965.

The process relates to a method of forming a tungsten or molybdenum coating on an alumina body. The method consists of applying a thin coating of powdered alumina, calcia, and an oxide of the aforementioned metal to the alumina body surface and firing the coated ceramic body in an atmosphere that is reducing to the metal oxide with the said coating containing between 84 and 95 weight percent of the metal oxide and the remainder being approximately equal amounts of alumina and calcia. (AEC)

28805 METHOD OF PREPARING URANIUM DIOXIDE FUEL COMPACTS. R. P. Levey and P. E. Trent (to U. S. Atomic Energy Commission). U. S. Patent 3,189,666. June 15, 1965.

A method for the preparation of high-density sintered uranium dioxide compacts is described. High-fired UO_2 of low sinterability is intimately mixed with highly sinterable UO_2 at a proportion of 1 to 10 wt % of the highly sinterable UO_2 and the mixture is compressed and sintered. The UO_2 mixture is formed into compacts without an added binder, and shrinkage and distortion during sintering are minimized. (AEC)

28806 FUEL ELEMENT FOR A NUCLEAR REACTOR HAVING STACK OF THIN FUEL WAFERS SUBMERGED IN LIQUID METAL. LeRoy R. Kelman and Owen L. Kruger (to U. S. Atomic Energy Commission). U. S. Patent 3,192,122. June 29, 1965.

Description is given of a fuel element for a liquid-metal-cooled nuclear reactor consisting of a stack of contiguous thin wafers of a material fissionable by neutrons of thermal energy wherein the wafers are less than six mils in thickness and thin enough to permit diffusion of fission gases to free surfaces in the element, a metal jacket having a hole in the top thereof surrounding the stack of wafers, and a liquid metal bonding agent in said jacket. (AEC)

Properties and Structure

Refer also to abstracts 28675 and 29159.

28807 (AECL-2250) THE PROPERTIES OF COLD-WORKED ZIRCONIUM–2.5 WT % NIOBIUM FUEL SHEATHING. K. P. Steward (Atomic Energy of Canada Ltd., Chalk River (Ontario)). Mar. 1965. 40p. Dep.; $1.00(AECL).

The properties of two batches of cold-worked zirconium–2.5% niobium fuel sheathing for use in the WR-1 and CANDU Reactors were investigated by a number of short-term tests. Axial tensile, ring tensile, and closed-end burst test properties were determined at temperatures up to 500°C, and data were also accumulated on recovery, crystallographic texture, residual stress, and susceptibility to stress orientation. Both axial and ring tensile tests showed similar trends to those observed in Zircaloy-2. Strain-age hardening was evident between 250 and 400°C, and minimum ductility at about 350°C. Burst strength above 400°C was less affected by temperature than axial or ring tensile strength, while minimum circumferential ductility occurred at about 450°C. Hardness tests indicated recovery at 450 and 500°C, but not at 400°C: slight hardening was apparent after short times at 350°C. The recovery curves suggested two processes occurring simultaneously, namely, relaxation of cold work, and aging due to rejection of β–Nb from supersaturated solid solution. The usual duplex texture for tube-reduced zirconium alloy tubing was observed, and residual stresses were low. The hydride orientation numbers were batch 1 fn = 0.12 and batch 2 fn = 0.18, while the thresholds for stress-reorientation of hydrides were about 9000 and 10,000 psi for batches 1 and 2, respectively. (auth)

28808 (AGN-8141) ALKALI METALS EVALUATION PROGRAM—THE DETERMINATION OF THE LATENT HEAT OF VAPORIZATION AND VAPOR PRESSURE OF

POTASSIUM FROM 1000 TO 1900°F. P. Y. Achener (Aerojet-General Nucleonics, San Ramon, Calif.). Apr. 1965. Contract AT(04-3)-368. 65p. Dep.(mn); $3.00(cy), 2(mn) CFSTI.

The latent heat of vaporization and vapor pressure of potassium were determined experimentally in the temperature ranges of 1008 to 1907°F and 985 to 1908°F, respectively. The apparatus designed for this measurement was of the flow calorimeter type, comprising a boiler with an internal heater and a guard heater, a condenser, and a volumeter in which the rate of vaporization was measured. The boiling temperature was established by means of an argon overpressure. For the latent heat of vaporization, a technique of double measurements was developed which permitted the elimination of heat losses between boiler and guard heater. The following equation was fitted to the latent heat data: $h_{fg_{Btu/lb}} = 948.5 - 0.1044\ T_{°F}$, with a standard error of estimate of ± 0.8%. For the vapor pressure the equation obtained was $\log_{10} P_{psia} = 5.31574 - (7707.31/T_{°F} + 459.7)$ with a standard error of estimate on the pressure of ± 0.65%. The normal boiling point calculated with this equation was 1398.1°F. Analysis of the results of the vapor pressure and latent heat determinations and comparison with results of other investigators have shown some of the limitations of the calculational method based on the Clapeyron equation to obtain latent heat from the vapor pressure data. This was evidenced by the fact that vapor pressure curves differing by less than 0.6% could have differences in slopes of up to 13%. (auth)

28809 (AP-Note-418) A SURVEY OF STRAIN-CYCLING DATA ON TYPICAL ARMY-REACTOR VESSEL MATERIALS. J. J. Waple (Alco Products, Inc., Schenectady, N. Y. Nuclear Power Engineering Dept.). May 1, 1962. Contract AT(30-1)-2639. 9p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

A literature survey was made on the plastic strain fatigue of the following materials: Type 304 and 347 stainless steel, low-carbon steel A-201, Al, Cu, Ti, carbon steel, and Dural. Both mechanical and thermal cycling are covered. The use of the data in the design of reactor vessels is discussed briefly. (D.L.C.)

28810 (BM-RI-6619) MECHANISM OF THE MONOCLINIC TO TETRAGONAL TRANSFORMATION OF ZIRCONIUM DIOXIDE. Clark F. Grain and Ronald C. Garvie (Bureau of Mines, College Park, Md. College Park Metallurgy Research Center). Sept. 1964. 21p. Free (Bureau of Mines).

The monoclinic to tetragonal inversion of zirconium dioxide was studied by single-crystal x-ray methods, high-temperature x-ray diffractometry, and differential thermal analysis. The unusual features of the inversion, such as no definite transition temperature, hysteresis, and athermal kinetics, were confirmed for powders whose mean crystallite size was greater than 1,000 A. Samples of mean crystallite size below 1,000 A displayed classical kinetics, obeying a logarithmic rate law. A detailed mechanism based on Ubbelohde's theory of continuous phase transformations was proposed which is consistent with all the experimental facts. (auth)

28811 (EURAEC-1320) PHYSICAL PROPERTIES OF UO_2 SINGLE CRYSTALS. Quarterly Report No. 11, July 1–October 31, 1964. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). Work Performed under United States–Euratom Joint Research and Development Program. Contract 056-64-3 TEEB. 16p. (EUR-2304). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

The self-diffusion coefficients for the U^{4+} ion in UO_2 were determined by analysis of the gradient in the ^{235}U concentration after diffusion anneals at 1300 and 1450°C. High temperature resistivity measurements were made on crystals in the $UO_2-UO_{2.25}$ composition range. The electrical conductivity and the Hall coefficient of a U_4O_{9-y} single crystal were determined in the temperature range from 240 to 660°K. Up to 370°K Rσ increases exponentially with temperature. The thermoelectric power of a reduced and a $UO_{2.013}$ single crystal was measured in the temperature interval 150 to 320°K. Internal friction and resonant frequency measurements were made between 77 and 300°K For a frequency of 888 cps, a peak was observed at 255°K. The corresponding activation energy was found to be 0.45 ev. (W.L.G.)

28812 (ORNL-3795) A BIBLIOGRAPHY ON TRACER DIFFUSION IN METALS. PART I. SELF-DIFFUSION IN PURE METALS. John Askill, comp. (Oak Ridge National Lab., Tenn.). May 1965. Contract W-7405-eng-26. 26p. Dep.; $2.00(cy), 1(mn) CFSTI.

Frequency factors and activation energies for self-diffusion in pure metals have been compiled from the literature reported between 1938 and 1964. An author index is included. (142 references) (auth)

28813 (UCRL-10316) PLASTIC DEFORMATION OF MgO SINGLE CRYSTALS UP TO 1600°C. Stephen M. Copley and Joseph A. Pask (Lawrence Radiation Lab., Univ. of California, Berkeley). Apr. 7, 1964. Contract W-7405-eng-48. 39p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

Stress-strain curves are presented for MgO single crystals, compressed with ⟨100⟩ and ⟨111⟩ stress axes, for temperatures of 1000 to 1600°C. The yield stress of ⟨100⟩ specimens decreases slightly in this temperature range. The strain-hardening rate passes through a maximum at about 1100°C and decreases by a factor of about 8 at 1600°C. Above this temperature, the strain rate of ⟨100⟩ specimens is much less sensitive to changes in stress and the shape of the stress-strain curves changes. The yield stress of ⟨111⟩ specimens decreases rapidly with increasing temperature without a change of slope up to 1600°C. The ratio of the yield stresses for ⟨111⟩ and ⟨100⟩ specimens decreases continually from 1200 to 1600°C. Various stress rates were used to obtain a measure of strain hardening at 1300°C. Static recovery experiments were carried out at 1000 and 1400°C. At 1000°C, static pinning occurred during the unloaded period; at 1400°C, "orthorecovery" occured. Stress-strain curves were analyzed by a dynamic approach based on the length of moving dislocation line in the crystal and the average dislocation velocity. (auth)

28814 (AERE-Trans-1017) STUDIES ON CARBIDES IN IRON AND STEEL BY ELECTROLYTIC ISOLATION. 4. BEHAVIOUR OF CEMENTITE DURING COLD-WORKING AND ANNEALING. Tomoo Sato and Taiji Nishizawa. Translated by B. K. Bowes (Atomic Energy Research Establishment, Harwell (England)), from Nippon Kinzoku Gakkaishi, 20: No. 1, 51-5(1956). 10p. Dep.; $0.50(BIS), 2s. 6d. (HMSO).

Electron-microscopic examinations were performed on cementite isolated from annealed, cold-rolled and subsequently annealed 0.65% carbon steels, and the behaviors of cementite during these treatments were studied with the following results: (1) During cold deformation of steel, a cementite crystal in the steel curves elastically, and then splits along its cleavage into many laminar fragments. The width of the split laminae lies in the range from 1500 to 3000 Å, and these laminae themselves show a fibrous structure, having a width of about 300 Å. In the case of spheroidal pearlite, however, the cementite globules suffer no change in the process of cold-rolling. (2) Due to annealing after cold-rolling, a crystalline cementite is spheroidized through three stages, that is, incubation, nucleation, and growth stages. The spheroidization of cementite is regarded as an "intra-cementitic" recrystallization phenomenon. (3) During prolonged annealing of normalized steel at a subcritical temperature, the crystalline cementite in it undergoes local thickening and local thinning, and finally separates into several cementite globules. The spheroidization of cementite in this case may be caused by surface tension and lattice imperfections inherent in the cementite. (auth)

28815 (ORNL-tr-632) SHORT-RANGE ORDER AND K-STATE. Hans Guenter Baer. Translated for Oak Ridge National Lab., Tenn., from Z. Metallk., 56: 79-84 (1965). 17p. Dep.(mn); $1.60(fs), $0.80(mf) JCL.

A short-range order was found roentgenographically in Ni–rich alloys of the Ni–W and Ni–Mo system. The

phenomena of the K-state are attributed to it. The relationship between the short-range order and the long-range order occurring also in each of the two systems is discussed and it was concluded from x ray results as well as from the fact that the formation of the long-range order proceeds via nucleation, that the short-range order is not directly transformed into the long-range order in the case of these K-state alloys. Short-range and long-range orders can exist side-by-side. A parallelism to the Ni–Cr system is shown. The cold-worked state approaches most closely that of the statistical solid solution. (auth)

28816 X-RAY STUDIES ON THE STRUCTURE OF GRAPHITIC CARBONS. W. Ruland (Union Carbide European Research Associates, Brussels). Acta Cryst., 18: 992-6(June 10, 1965).

The disorder in the layer stacking of graphitic carbons is interpreted in terms of a statistical distribution for the positional correlation between adjacent layers and stacking faults for the second layer influence. Experimental data show the variation of the root-mean-square values of statistical distribution and the stacking fault parameters in the transition from non-graphitic carbons to graphite. (auth)

28817 NEW INTERMEDIATE PHASES IN TRANSITION METAL SYSTEMS. II. B. C. Giessen and N. J. Grant (Massachusetts Inst. of Tech., Cambridge). Acta Cryst., 18: 1080-1(June 10, 1965).

Ordered intermediate phases of binary and ternary transition metal systems containing a refractory metal component were examined and the crystal system, structure type, and layer structures identified and the lattice parameters measured. (W.L.G.)

28818 CRYSTAL STRUCTURES OF SOME EQUIATOMIC GADOLINIUM COMPOUNDS. Karl A. Gschneidner, Jr. (Los Alamos Scientific Lab., N. Mex.). Acta Cryst., 18: 1082-3(June 10, 1965). (LA-DC-6734)

Equi-atomic alloys of Gd were prepared and the crystal structures determined by x ray diffraction methods. The compounds GdCu, GdRh, and GdAg were found to have bcc, CsCl, B2 type structures. The x-ray patterns of GdAl and GdAu possessed lines for both CsCl bcc and orthorhombic structures. The corresponding orthorhombic structure types are CeAl for GdAl and CrB for GdAu. The results obtained in this study are in reasonable agreement with previously published data, except for GdAl. (W.L.G.)

28819 THE CRYSTAL STRUCTURE OF Yb_3Ge_5. Gordon S. Smith, Quintin Johnson, and A. G. Tharp (Univ. of California, Livermore). Acta Cryst., 18: 1085-6(June 10, 1965). (UCRL-12115)

Well-formed single crystals of Yb_3Ge_5 were made by arc-melting the components in a Zr-gettered argon atmosphere. Each preparation was turned and remelted several times to homogenize the sample. The crystals were hexagonal with a structure derived from the C32-AlB_2 type by the systematic removal of one-sixth of the Ge atoms. The atomic positions and parameters, the interatomic distances, and the structure factors for Yb_3Ge_5 were calculated. (W.L.G.)

28820 PREFERRED ORIENTATION IN ROLLED AND EXTRUDED ISML SAP CONTAINING 4-, 7-, AND 10% Al_2O_3. G. Bonissoni and M. Paganelli. Alluminio, No. 6, 285-9(1964). (EUR 757.1). (In Italian)

Preferred orientations in SAP sheets and extruded bars were determined by Schulz method, and pole figures of the surface and inside texture of sheets were planned. It was observed that the number of random distributed crystals increased with Al_2O_3 content, and at approximately the center of the sheet thickness the preferred orientation corresponds well to the ideal orientation (110) [$1\bar{1}2$], while the surface texture is not far from the ideal orientation (320) [$2\bar{3}5$]. Pole figures of SAP sheets are different from those of commercial Al, it may be supposed that, in SAP, plastic deformation takes place on the same slip systems of Al but under different conditions. (auth)

28821 FOR THE KNOWLEDGE OF THE PHYSICAL PROPERTIES OF LIQUID METALS. PART I. TEMPERATURE RANGE BETWEEN MELTING AND BOILING POINT. K.-H. Spiller (Euratom, Ispra, Italy). Atomkernenergie, 10: 127-38(Mar.-Apr. 1965). (In German)

The physical properties of some important liquid metals (sodium, potassium, NaK, Pb-Bi eutectic, and tin) in the temperature range between point of fusion and the boiling point were studied by analysis of the literature. Data are summarized in graphs and tables. (96 references). (auth)

28822 EFFECTS OF PRESTRAIN ON THE TENSILE PROPERTIES OF GRAPHITE. Morton C. Smith (Los Alamos Scientific Lab., N. Mex.). Carbon, 2: 269-74 (1964). (LA-DC-6321)

Data are presented demonstrating the effects on the transverse tensile strength of H4LM graphite of tensile prestraining in static helium at 2500°C and 0.005/min strain rate. Strength measurements after prestraining were at 2500, 2250, 2000, 1750, 1500°C, and room temperature, at strain rates of 0.005 and 2.0/min. Results are correlated with strength measurements made under similar conditions on the same graphite as-received, subjected to similar thermal cycles without prestrain, annealed at the testing temperature after prestraining, and cooled and reheated between prestraining and tensile testing. These observations and certain others previously made on the same and similar graphites are used to develop a microstructural explanation of the tensile behavior of graphite, based on localized cracking both by external loads and by stresses induced by anisotropic thermal contraction, on crack closure and healing by anisotropic thermal expansion, and on crack healing by stress-directed mass transport of carbon. (auth)

28823 THE MOLYBDENUM–VANADIUM–OXYGEN SYSTEM. Gabriel Tridot, Joseph Tudo, Genevieve Leman-Delcour, and Michel Nolf (Faculte des Sciences, Lille). Compt. Rend., 260: 3410-13(Mar. 22, 1965). (In French)

The hydrogen reduction of the compound MoO_8V_2 began close to 400°C, led between 550 and 600°C, to the phases MoO_2 and V_2O_3, and then to the phases Mo and V_2O_3 beginning at 700°C. In the presence of sulfur dioxide, at 650°C the mixture MoO_3 and V_2O_5 gave the phase MoO_5V, which was recovered by solid-state reaction between MoO_3 and VO_2. The reduction of this compound by hydrogen began at 800°C in the mixture of the Mo and V_2O_5 phases; under oxygen, it evolved directly into MoO_4V_2 and MoO_3, obtained at 570°C. (tr-auth)

28824 HIGH TEMPERATURE STUDY OF THE ALLOTROPIC TRANSFORMATIONS OF THE SESQUIOXIDES OF TERBIUM, DYSPROSIUM, AND HOLMIUM. Marc Foex, Jean-Pierre Traverse, and Jean-Pierre Coutures (Centre National de la Recherche Scientifique, Montlouis, France). Compt. Rend., 260: 3670-3(Mar. 29, 1965). (In French)

The existence at high temperature of monoclinic and hexagonal forms of Tb_2O_3, Dy_2O_3, and Ho_2O_3 was shown. The transition temperatures were determined. (tr-auth)

28825 ELECTRICAL PROPERTIES OF OXIDES OF RARE-EARTH ELEMENTS. N. P. Bogoroditskii, V. V. Pasynkov, Rifat Rizk Basili, and Yu. M. Volokobinskii (Leningrad Electrotechnical Inst.). Dokl. Akad. Nauk SSSR, 160: 578-81(Jan. 21, 1965). (In Russian)

The electric properties of oxides of rare-earth elements (r-e) were investigated at temperatures up to 1300°C. The temperature dependence of resistivity showed that Tb_2O_3 and PrO_2 are semiconductors, while other r-e oxides can be classed as dielectrics. All r-e oxides have electron conductivity. Ion conductivity constitutes less than 0.25% of the total conductivity. The room temperature dielectric constant (ϵ) of Gd_2O_3, Ho_2O_3, and Yb_2O_3 is independent of the frequency in the 50-kc to 30-Mc range, and changes very slightly in the 20–300°C range at a frequency of 1 Mc. At 20–300°C, the temperature coefficient of ϵ for Ho_2O_3 is practically zero, which makes Ho_2O_3 suitable for making capacitors with stable properties. Yb_2O_3 appears to be a likely material for making thin-film nonlinear

elements. It has a cubic structure, is stable, and does not undergo phase transformations with heating in air up to the melting temperature. Metallic Yb has the lowest melting and vaporization temperatures (824 and 1427°C) among the r-e metals, which makes it the most suitable for making thin films by vacuum evaporation and subsequent oxidation. (ATD)

28826 ANTIFRICTION PROPERTIES OF SOLIDS AT HIGH TEMPERATURES IN A VACUUM AND IN SOME GASEOUS MEDIA. A. P. Semenov and V. V. Pozdnyakov (State Scientific Research Inst. of the Science of Machines, USSR). Dokl. Akad. Nauk SSSR, 160: 811-14(Feb. 1, 1965). (In Russian)

An investigation was made of the friction between identical materials in a vacuum of 10^{-4} to 10^{-5} mm Hg and in an atmosphere of Ar, He, or N_2 at temperatures up to 2000°C. Graphite-base materials, and TiC, VC, Cr_3C_2, NbC, Mo_2C, WC, CrB, ZrB_2, SiC, and MgO were tested under a load of 5 kg and a sliding speed of 0.8 m/min. In vacuum, the friction coefficient of graphite-base materials decreased from 0.7–0.75 at 20°C to 0.1–0.15 at temperatures over 1500°C. Admission of air in a vacuum chamber at room temperature sharply decreased the friction coefficient from 0.7 to 0.08. In the He, Ar, and N_2 atmospheres, the friction coefficient differed only slightly from that in a vacuum. At 1000°C, the highest friction was observed in He and the lowest in N_2. The friction behavior of the investigated compounds followed a similar pattern, except for CrB whose friction coefficient increased at temperatures over 1550°C. At 1000°C, TiC and NbC had the lowest friction coefficients and Mo_2C and WC, the highest. Admission of air in a vacuum chamber sharply reduced friction in the case of TiC but had no effect on other carbides. In the He, Ar, or N_2 atmospheres, the average value of the friction coefficient changed only slightly. In the friction between AG-1500 graphite-base material and carbides, the properties of the graphite material play a major role. Adhesion tests in vacuum showed that seizing between like materials is characteristic for all refractory compounds (not for graphite-base materials). However, seizing occurred at higher homologous temperatures than for corresponding pure metals. The temperature of the beginning of adhesion varied from 1000 and 1955°C for Mo_2C and NbC, respectively. (CFSTI)

28827 SPONTANEOUS TRANSITION OF THE SLIDING FRICTION TO ROLLING FRICTION IN HIGH-TEMPERATURE TESTING OF REFRACTORY CARBIDES. A. P. Semenov and V. V. Pozdnyakov (State Scientific Research Inst. of Machine Science, USSR). Dokl. Akad. Nauk SSSR, 160: 1057-60(Feb. 11, 1965). (In Russian)

A spontaneous change from sliding to rolling friction was observed during high-temperature tests of friction between MoC or VC specimens in a vacuum. In the tests with MoC specimens, an increase in temperature to 1250°C sharply increased the friction moment under unchanged load. At about 1700°C the friction coefficient rose to almost 1.0, after which, however, the load (applied by a flat spring) increased spontaneously and the friction moment sharply decreased as the friction coefficient decreased to 0.19 and then to 0.09. Examination of the contact surfaces revealed the presence of rounded particles of MoC about 1.5 mm in diameter and fairly wide and deep grooves with smooth, bright surfaces. A reverse transition from rolling to sliding friction with the friction coefficient somewhat lower than the initial was observed with decreasing temperature. A similar phenomenon was observed in specimens of VC. It appears that with increasing temperature, the investigated carbides become more susceptible to seizing and plastic deformation. Under certain conditions, the torn-out particles begin to roll between the surfaces and to grow in size like a snowball. The bodies of rotation thus formed attain an equilibrium for the given conditions and roll in the grooves which are gradually formed on the friction surfaces. With gradually decreasing temperature, the seizing stops and the bodies of rotation cannot maintain their size. This results in wear of crushing of the extant bodies of rotation and in a reverse transition from rolling to sliding friction. (CFSTI)

28828 ELASTICITY CHARACTERISTICS OF POLYCRYSTALLINE NIOBIUM. I. M. Nedyukha and V. G. Chernyi. Dopovidi Akad. Nauk. Ukr. RSR, No. 3, 339-41 (1965).

The elasticity constants of cast, polycrystalline, 99.4% pure niobium were measured using a dynamic ultrasonic-impulse method. Results of the measurements, accurate to 1.5%, showed that Young's modulus E = 10650 kg/mm², the shear modulus G = 3800 kg/mm², the bulk modulus Q = 17400 kg/mm², and the Poisson's ratio μ = 0.398. The characteristic temperature and the rms displacement of atoms from the equilibrium-position, calculated on the basis of the obtained value of E, were found to be 265°C and 0.136 Å, respectively. (CFSTI)

28829 ELECTRICAL RESISTIVITY AND THERMAL EMF OF La–Ce, La–Pr, AND Pr–Nd ALLOYS. M. V. Vedernikov, I. A. Markova, and G. N. Meshkova. Fiz. Tverd. Tela, 7: 950-2(1965).

No changes occurred in the electrical conductivity of La–Pr and Pr–Nd rare-earth metal alloys when the composition of the materials was varied from 0 to 100%. This linear dependence was unexpected, because, even though each alloy has two similar components, the atomic and crystallographic differences of these components are sufficiently marked to produce an increase of resistivity of 2 to 3%. Such an increase was actually observed in La–Ce, the third rare-earth metal alloy investigated. The linearity of the dependence between conductivity and composition moreover seemed to disagree with similar measurements performed on other continuous-series solid solutions whose resistivities as functions of composition have a convex curve with a maximum occurring at a component ratio near 50:50%. It is suggested that lattice damage in the mixing of components is responsible for the increased resistivity. It is therefore assumed that in the case of La–Pr and Pr–Nd some compensating mechanism comes into play which is perhaps connected with the magnetic moment of ions and consequently enhances conductivity. A study of the thermal emf versus composition of the three alloys showed that with small admixtures of the second component irregularities appear. It is conceded, however, that these might have been caused by insufficient purity of the samples. (CFSTI)

28830 VISCOSITY OF LIQUID DILUTE SOLUTIONS OF LANTHANUM AND CERIUM IN IRON. A. A. Romanov and V. G. Kochegarov. Izv. Akad. Nauk SSSR, Met. i Gorn. Delo, No. 6, 86-8(Nov.-Dec. 1964). (In Russian)

The kinematic viscosity was determined over a temperature range of 1500 to 1800°C for iron solutions containing 0.4, 0.8, 1.5, 3.0, and 3.5 wt % La, and also for a series of iron solutions containing 0.2, 0.4, 0.6, 0.8, 1.0, 1.75, 3.0, and 5.0 wt % Ce. The presence of La had hardly any effect on the viscosity of the iron solution, but in the Fe–Ce system the viscosity decreased noticeably with a minimum at 1.75 to 3.0 wt % Ce. The increase in entropy of viscous flow ΔS_η from 8.5 joules/°K at 0.2 wt % Ce to 20.2 joules/°K at 5.0 wt % Ce indicated the formation of a transitory complex in the Fe–Ce system. (TTT)

28831 EFFECTS OF LANTHANUM, TIN AND CADMIUM ON MAGNESIUM RECRYSTALLIZATION. S. B. Fel'gina. Izv. Akad. Nauk SSSR, Met. i Gorn. Delo, No. 6, 137-41(Nov.-Dec. 1964). (In Russian)

The content of minor alloying elements in magnesium alloys was varied from 0.02 to 0.5 at. % (0.1 to 2.75 wt %) in Mg–La alloys, from 0.05 to 3.3 at. % (0.25 to 14.5 wt %) in Mg–Sn alloys, and from 0.05 to 1.0 at. % (0.25 to 4.5 wt %) in Mg–Cd alloys. Pressed samples 30-mm long with a cross section of 10 × 10 mm were deformed on a hydraulic press in two stages perpendicular to the direction of pressing. The first upset was carried out at a temperature of 350°C with a 50% deformation to a thickness of 5 mm, and the second upset of the annealed sample was carried out in the cold state with a 60% deformation to a thick-

ness of 2 mm. The deformed samples 10 × 10 mm in size with a thickness of 2 mm were annealed at temperatures of 75 to 450°C with air cooling. The initial and final recrystallization temperatures were determined by microstructural and x-ray analyses. The final recrystallization temperature corresponds to the disappearance of all signs of deformation. With an addition of 0.1 wt % La, the initial recrystallization temperature increased sharply from ~100 to 200°C, and attained a maximum recrystallization temperature of 225°C with 0.2 wt % La. Cd and Sn had lesser effects than La on the recrystallization temperature of Mg. (TTT)

28832 DIFFUSION COEFFICIENTS AND ANION VACANCY CONCENTRATIONS FOR THE ZIRCONIUM–ZIRCONIUM DIOXIDE SYSTEM. Tennyson Smith (North American Aviation Science Center, Thousand Oaks, Calif.). J. Electrochem. Soc., 112: 560-7(June 1965).

Experiments were carried out at 386°C to determine the concentration of anion vacancies at the metal-oxide interface and the diffusion coefficients for anion vacancies in zirconium dioxide films on zirconium by the "interruption kinetic technique." The conditions for which this technique is valid are discussed. The anion vacancy concentration in the oxide at the oxide-metal interface (386°C) proved to be $(7 \pm 0.7) \times 10^{-3}$ g atom/cm^3 as compared to $(2.2 \pm 2) \times 10^{-3}$ calculated from the phase diagram. An equation is given for calculating diffusion coefficients. Theoretical calculations of the entropy of vacancy formation and values of D_0 were made assuming three models. It was concluded that electrons are trapped at anion vacancies or impurity centers, rather than act as Fermi-electrons in the conduction band. (auth)

28833 INVESTIGATION OF MECHANICAL PROPERTIES OF Nb–W–Mo–Zr ALLOYS. E. M. Savitskii and A. M. Zakharova (Lvov Ivan Franko State Univ., Ukrainian SSR). Metalloved. i Term. Obrabotka Metal., No. 3, 8-16 (Mar. 1965). (In Russian)

Nb alloys containing a total of 10, 15, 20 and 30 wt % Mo, W, and Zr as minor alloying ingredients were prepared by fusion in an arc furnace in an atmosphere of purified helium. The hot hardness at 1500°C was determined on annealed samples. At room temperature Zr was the most effective in increasing the hardness of niobium, but at 1500°C tungsten was the most effective in increasing the hot hardness of niobium. The hardness at 1500°C increased with increasing content of W, Mo, and Zr. The tensile strength of the Nb alloys at 1000 to 1200°C was 30 to 60 hg/mm^2, and dropped to 7 to 19 hg/mm^2 at 1500 to 1600°C. The relative elongation of the Nb alloys was 10 to 20% at 1000°C, and 30 to 50% at 1500 to 1600°C. The tensile strength of recrystallized niobium as a function of temperature at 1000 to 1600°C is given by the following linear equation: $\sigma_b^t = 17 - 0.022\ (t - 1000°C)$. The strength properties of the Nb alloys at 1000 to 1600°C can be expressed by a decreasing exponential function as follows: $\sigma_b^t = \sigma_b^{1000°C} \exp[-\alpha(t - 1000°C)]$. The temperature coefficient α varied from 1.8 to 3.3 for various Nb alloys. The value of $\sigma_b^{1000°C}$ varied from 36 to 66 hb/mm^2 for various Nb alloys. The tensile strength was related to the Vickers hardness of the Nb alloys as follows: $\sigma_b = 0.34\ H_v$ at room temperature, and $\sigma_b = 0.36\ H_v$ at 1300 to 1500°C. (TTT)

28834 OXIDATION RESISTANT COATINGS, THEIR APPLICATION AND CAPABILITIES. C. A. Krier and J. M. Gunderson (Boeing Co., Seattle). Metals Eng. Quart., 5: No. 2, 1-16(May 1965).

A thorough review was made on the technology of oxidation resistant coatings with emphasis on the factors that limit coating life and determine reliability, the methods and some of the pitfalls involved in evaluating coated materials, and the properties of coated materials. Also discussed are the materials and processes used for preparing oxidation-resistant coatings and end-item application areas for these materials. Coated steels and superalloys are used commercially. Coated refractory alloys have been flight tested successfully, and are expected to find increased use in the future. Coatings for graphite and thoria-dispersed nickel are primarily at the research stage, but significant progress is being made, particularly for thoria-dispersed nickel. Oxidation resistant coatings are serving in an important capacity in current high-temperature technology, and their role can be expected to increase in importance in the future as greater use of composites is required to satisfy increasingly severe requirements. (auth)

28835 DIGERMANIDES OF SCANDIUM AND YTTRIUM. O. Schob and E. Parthe (Univ. of Pennsylvania, Philadelphia). Monatsh. Chem., 95: 1466-72(1964). (In German)

Mixtures of Sc and Y with Si and Ge were prepared by cold pressing and fusion under Ar in an arc or an induction oven. Homogenization was carried out at 1200°C in evacuated fused quartz ampoules for 4 hours. In the system Sc–Ge, a compound $ScGe_2$ was found with the $ZrSi_2$ structure (C 49 type); lattice constants were: $a = 3.88_8$, $b = 14.87_3$, and $c = 3.79_3$ Å; space group D_{2v}^{17} Cmcm (four Sc atoms and two groups of four Ge atoms each in the 4c point positions) with the free parameters $y_{Sc} = 0.103$, $y_{Ge_I} = 0.435$, $y_{Ge_{II}} = 0.750$. No $ScSi_2$ was found, but for Sc_2Si_3, $a = 3.66_4$, and $c = 3.87_7$ Å, and $c/a = 1.058$. A defect structure (C 32) is proposed, and there appeared to be a region of homogeneity between Sc_2Si_3 and Sc_3Si_5 with slight changes in the lattice constants. For the latter compound, a was found to be 3.64_6 and $c = 3.88_1$ Å. The compound Y_2Ge_3 crystallized hexagonally: $a = 3.93_5$ and $c = 4.13_9$ Å, and $c/a = 1.052$. Other phases were always noted in the patterns, but this also obviously had the AlB_2 defect structure as did Sc_2Si_3. Two crystal structures were found for YGe_2: a tetragonal one, $a = 4.060$, and $c = 13.683$ Å, and $c/a = 3.37$; point group D_{4h}^{19}–I 4_1; and $z_{Ge} = 0.413$. Another structure was prepared by heating this sample to 1200°C for 4 hours. It was similar to the C 49 type, but was not further determined. (BBB)

28836 LATTICE CONSTANTS AND STRUCTURES OF THE COMPOUNDS DyHg, HoHg, ErHg; $DyHg_2$, $HoHg_2$, $ErHg_2$; $DyHg_3$, $HoHg_3$, AND $ErHg_3$. H. R. Kirchmayr (Technische Hochschule, Vienna). Monatsh. Chem., 95: 1667-70(1964). (In German)

Rare earths of at least 99.9% purity were mixed with twice-distilled Hg in stoichiometric proportions. The preparations were indicated to be one-phase by roentgenography and the composition was shown to be ±5% of theoretical with x-ray fluorescence. Data from Debye-Scherrer recordings are given with calculated intensities; CrKα radiation was used. Compounds with one Hg were found to be cubic (B 2); for Dy, a = 3.672; Ho, 3.646; Er, 3.628 Å. Compounds with two equivalents of Hg had a AlB_2 (C 32) structure; for Dy, a = 4.817, c = 3.474; for Ho, a = 4.803, c = 3.464; for Er, a = 4.790, c = 3.442 Å. Compounds of the formula MHg_3 crystallize in the Mg_3Cd (DO_{19}) form: a = 6.524, c = 4.890 for Dy; for Ho, a = 6.507, c = 4.884; for Er, a = 6.496, c = 4.877 Å. The compounds of the type MHg are similar to the previously reported examples of MHg where M = Sc, Y, La, Ce, Pr, Nd, Sm, and Gd. Similarly to the case for $ScHg_3$ and YHg_3, a unit cell doubled in the a axis is assumed for the new MHg_3 compounds. (BBB)

28837 STRUCTURE DATA FOR SOME ARSENIC AND GERMANIUM-RICH COMPOUNDS OF MOLYBDENUM. Allan Brown (Uppsala Univ.). Nature, 206: 502-3 (May 1, 1965).

X ray diffraction techniques were used to determine the crystal structure, space group, and cell dimensions of $MoAs_2$, $Mo_{0.4}As_2$, $MoGe_2$, $MoGe_{1.7}$, Mo_3Sb_7, and $MoSn_{1.5}$. Atomic positions, parameters and temperature factors are given for the $MoAs_2$, $Mo_{0.4}As_2$, and $MoGe_2$ compounds. (W.L.G.)

28838 LEAD SHIELDING: SOME TECHNICAL AND COMMERCIAL ASPECTS. R. Smith. Nucl. Energy, 157-60(May 1965).

The advantages of lead shielding, the various types of lead, and the availability of special products and their properties are described. The use of special manufacturing techniques, which are so essential to efficiency

and economy, are also discussed. The problems and techniques described refer generally to massive lead shields such as those likely to be encountered in the construction of transport containers. (P.C.H.)

28839 REFRACTIVE INDICES OF FLUORIDE INTERFERENCE FILMS ON THORIUM DIOXIDE. W. P. Ellis and R. M. Lindstrom (Los Alamos Scientific Lab., N. Mex.). Opt. Acta, 11: 287-94(Oct. 1964). (LA-DC-6627)

Optically isotropic interference films of uniform thicknesses were formed on the flat surface of oriented, single-crystalline thorium dioxide by reaction with anhydrous gaseous hydrogen fluoride. The films were studied by immersion spectrophotometry, from which the optical constants were determined as a function of wavelength, order of interference, angle of incidence and plane of polarization. (auth)

28840 LOCALIZED MAGNETIC IMPURITY STATES IN Ti, Zr, AND Hf. J. A. Cape and R. R. Hake (Atomics International, Canoga Park, Calif.). Phys. Rev., 139: A142-9(July 5, 1965).

An experimental study of localized moments on magnetic impurities (≈0.2 at. % of Cr, Mn, Fe, Co, or Gd) in the group IV transition elements Ti, Zr, and Hf was carried out. From magnetic-susceptibility measurements a localized moment on Mn of ≈3.5 μ_B in each of the solvents Ti, Zr, and Hf was found. Chromium forms a moment in Zr (0.2 μ_B) and in Hf (1.7 μ_B) but not in Ti. Iron forms a moment in Hf (0.7 μ_B) but not in Ti or Zr. Thus the tendency towards localized-moment formation on these 3d ions increases in the sequence Ti–Zr–Hf, possibly because of the decreasing solvent electronic-state density. Negative magnetoresistance is produced by each d-shell impurity for which magnetic-susceptibility measurements indicate a localized moment. The magnetoresistivity and susceptibility data are shown to be correlated in the weak-field limit by the elementary molecular-field description and the assumption that the magnetoresistance is proportional to the square of the magnetization. Resistivity minima are observed in pure (arc-cast, iodide process) Ti and Ti-Cr, -Mn, and -Fe; Zr-Mn; and Hf-Cr, -Mn, and -Fe. It thus appears that there is no strict correlation of resistivity minima and localized moments for the d-shell impurities. The resistivity-versus-temperature curves are not explained by the recent theory of Kondo. It is suggested that this apparent disagreement can be accounted for in part if one assumes a substantial temperature dependence of the nonmagnetic impurity-potential scattering, which was not included in Kondo's theory. For Gd in the group IVB solvents, a nearly free-atom moment is observed in Zr (7.0 μ_B) and Hf (6.1 μ_B), (Ti-Gd was not examined). No resistivity minima and only a very small negative magnetoresistance are observed in the alloys with Gd, suggesting a much weaker conduction-electron interaction with the localized magnetic states of the f-shell ions than with the localized moments on the d-shell impurities. (auth)

28841 ANALYSIS OF ALKALI-METAL SPECIFIC-HEAT DATA. Douglas L. Martin (National Research Council, Ottawa). Phys. Rev., 139: A150-60(July 5, 1965).

Published data on the density, thermal-expansion coefficient, and compressibility of the alkali metals are reviewed, and best values for the density as a function of temperature and for the Grüneisen constant $\gamma(0)$ are selected. From published specific-heat data the entropy and its corresponding Debye temperature (Θ^S) are computed as a function of temperature for the body-centered-cubic phase. The values of the first few even moments and some negative moments of the lattice-vibration spectrum are calculated for each alkali metal (bcc phase) on the basis of two different approximations as to the form of the anharmonic specific-heat contribution. The anharmonic contribution is found to be positive for all the alkali metals. There appears to be a systematic change in the shape of the vibration spectrum on going from sodium to cesium. The spectrum moments found for sodium are in good agreement with those obtained from neutron-scattering experiments on this metal. (auth)

28842 GREEN'S FUNCTION THEORY OF MAGNETIC RELAXATION. III. THE CASE OF AN ALTERNANT MAGNET. Kazuhisa Tomita and Motoyuki Tanaka (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto), 33: 1-21 (Jan. 1965).

The thermodynamical Green's function is investigated for a localized spin system having an alternant character, such as an antiferromagnet and a ferrimagnet, or a paramagnet having an alternant variation in g-factor. It is expressed in terms of spin polarization and the spatial correlations of spin deviations, which are also calculated in the framework of the Green's function method. Paramagnetic susceptibility of an antiferro- and a ferri-magnet are discussed using the lowest-order solution. Inclusion of the higher-order contributions is shown to give an exact spectrum of an antiferromagnet at low temperatures and also to give the resonance width over a whole range of temperature, although it is not so easy to arrive at its final expression at low temperatures. (auth)

28843 ON THE DISPERSION HARDENING OF HIGH-MELTING METALS. H. Braun (Climax Molybdenum Co., Zurich). Schweiz. Arch. Angew. Wiss. Tech., 31: 65-76 (Mar. 1965). (In German)

It was shown that in the high-melting metals W, Mo, Nb, and Ta dispersions were used for solidification and to increase their utilization temperature. Oxide phases, foreign to the metal, were chiefly used in the sintered metals or their alloys. In molten alloys, however, dispersions of the same kind can occur, which can induce precipitation hardening. (tr-auth)

28844 THE HIGH-TEMPERATURE BEHAVIOR OF LITHIUM-6 IN BeO MODERATOR MATERIAL. L. J. Stieglitz and L. R. Zumwalt (General Atomic, San Diego, Calif.). Trans. Am. Nucl. Soc., 8: 1-2(May 1965).

28845 THE MIGRATION OF XENON THROUGH A UO_2 MATRIX CONTAINING TRAPPING SITES. J. R. Mac Ewan (Atomic Energy of Canada Ltd., Chalk River, Ont.). Trans. Am. Nucl. Soc., 8: 21(May 1965).

28846 DIFFUSION IN DOPED UO_2. H. J. Matzke (Atomic Energy of Canada Ltd., Chalk River, Ont.). Trans. Am. Nucl. Soc., 8: 26-7(May 1965).

28847 STRUCTURE OF U–20 WT% Pu-FISSIUM ALLOYS. O. L. Kruger (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 28(May 1965).

28848 A STUDY OF AS-CAST AND HEAT-TREATED URANIUM-BASE DILUTE-CARBON ALLOYS BY OPTICAL AND ELECTRON MICROSCOPY. William A. Althaus, Marlin M. Cook and Richard J. Bieker (National Lead Co. of Ohio, Cincinnati). Trans. Am. Nucl. Soc., 8: 28-9(May 1965).

28849 HIGH-TEMPERATURE THERMODYNAMIC EQUATION OF STATE OF PLUTONIUM CARBIDE. C. J. Kubit, R. G. Palm, and W. Gunson (Westinghouse Electric Co., Pittsburgh). Trans. Am. Nucl. Soc., 8: 29-30(May 1965).

28850 FISSION-PRODUCT DIFFUSION IN METALS. J. E. Howes, Jr., D. L. Morrison, A. A. Bauer, T. S. Elleman, and D. N. Sunderman (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Nucl. Soc., 8: 30-1(May 1965).

28851 THE COMPATIBILITY OF TUNGSTEN WITH MOLTEN UO_2. B. Weidenbaum (General Electric Co., San Jose, Calif.) and H. Hausner. Trans. Am. Nucl. Soc., 8: 32(May 1965).

28852 INTERACTION AND DIFFUSION IN THE UO_2/Mo SYSTEM. A. I. Kaznoff, M. J. Sanderson, and J. E. Van Hoomissen (General Electric Co., Pleasanton, Calif.). Trans. Am. Nucl. Soc., 8: 32-3(May 1965).

28853 ELECTRICAL-PROPERTY STUDY ON UO_2–PuO_2 SOLID SOLUTIONS. W. E. Baily and W. L. Lyon (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 8: 34(May 1965).

28854 IN-PILE DIRECT MEASUREMENT OF UO_2 THERMAL CONDUCTIVITY. D. H. Coplin, H. Hausner, M. F. Lyons, and B. Weidenbaum (General Electric Co., Pleasanton, Calif.). Trans. Am. Nucl. Soc., 8: 35-6(May 1965).

28855 THERMAL CONDUCTIVITY OF 20 : 80(Pu : U)O_2. F. J. Hetzler, T. E. Lannin, K. J. Perry, and E. L. Zebroski (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 8: 36-7(May 1965).

28856 THE HIGH-TEMPERATURE COMPRESSION STRENGTHS OF URANIUM–CARBON ALLOYS. Sidney G. Nelson and Ellis L. Foster, Jr. (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Nucl. Soc., 8: 38-9(May 1965).

28857 IN-PILE THERMAL CONDUCTIVITY OF UO_2 AND 20 : 80(Pu : U)O_2 SPECIMENS. W. E. Baily, D. P. Hines, and E. L. Zebroski (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 8: 39-40(May 1965).

28858 ON THE THERMAL STRESS ENDURANCE OF NUCLEAR FUELS. Antonio J. Carrea and James F. Schumar (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 45-6(May 1965).

28859 MELTING POINTS OF CURIUM AND AMERICIUM OXIDES. R. E. McHenry (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 75-6(May 1965).

28860 MECHANICAL PROPERTIES OF FUEL CLADDING—THEIR ROLE IN SUPERHEAT FUEL-ELEMENT PERFORMANCE. John Gittus (United Kingdom Atomic Energy Authority, Springfields, Lancs, Eng.). Trans. Am. Nucl. Soc., 8: 119(May 1965).

28861 DIFFUSE X-RAY SCATTERING AND COOPERATION FOR THE α-β TRANSITION OF QUARTZ. Heinrich Arnold (Max-Olanck-Institut fur Silikatforschung, Wurzburg, Ger.). Z. Krist., 121: 145-57(Apr. 1965). (In German)

The co-operation of the Si and O atoms in quartz during the α-β transition was determined by means of diffuse x-ray scattering. Above 400°C a strong interaction between the Si–O–Si–O chains occurs. They move in the ⟨100⟩ chain direction, co-operating statistically in {100} planes. A distinction between static disorder and lattice vibrations could not be made by means of the diffuse x-ray patterns alone. The displacements of the atoms are small compared with their interatomic distances. (auth)

28862 A NEUTRON CRYSTALLOGRAPHIC INVESTIGATION OF LEAD MOLYBDENUM OXIDE, $PbMoO_4$. Janusz Leciejewicz (Kjeller Research Establishment, Norway). Z. Krist., 121: 158-64(Apr. 1965).

The oxygen parameters in one representative of the scheelite-type structure: lead molybdenum oxide, wulfenite, were determined by neutron diffraction using a single crystal. The following coordinates of the oxygen atom were found: $x_0 = 0.2352$, $y_0 = 0.1134$, $z_0 = 0.0439$. The refinement was carried out by a least-squares procedure on an electronic computer. The structure consists of MoO_4 tetrahedra. The Mo–O distance within this tetrahedron is 1.772 Å indicating a covalent link. Each lead atom is surrounded by 8 oxygen atoms belonging to 8 different MoO_4 units. The Pb–O distances are: 2.610 Å, four times, and 2.630 Å, four times. (auth)

28863 EFFECT OF THE STRUCTURAL STATE ON THE SUPERCONDUCTING PROPERTIES OF ZIRCONIUM ALLOYS CONTAINING 20–25% NIOBIUM. Yu. F. Bychkov, I. N. Goncharov, and I. S. Khukhareva (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 48: 818-24(Mar. 1965). (In Russian)

A detailed investigation was carried out on the effect of the structural state on the superconducting and mechanical properties of alloys. The following properties were measured: electric resistance, critical temperature, the dependence of critical current density on the direction between the magnetic field and the rolling surface, maximum tensile strength, hardness and the relative elongation as a function of temperature of one-hour annealing. The most interesting properties were found in the region of the α-phase or metastable ω-phase (high values of j_K; in the latter case current anisotropy is also almost completely absent). The results are qualitatively explained on basis of the Anderson model. It is shown that j_K may increase even if the number of dislocations or vacancies decreases, providing other mechanisms of current stabilization exist. A relation between the variation of T_K and decay of a β-solid solution during annealing is detected. (auth)

28864 INVESTIGATION OF TIN BY THE TUNNEL EFFECT. N. V. Zavaritskii (Inst. of Physical Problems, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 48: 837-44(Mar. 1965). (In Russian)

The width of the gap Δ in the energy spectrum of the electrons of a single crystal of tin in the superconducting state was investigated by the tunnel method. The complex nature of the anisotropy of Δ is ascribed to the presence of surfaces along each of which Δ varies only slightly. The surfaces reconstructed on basis of the experimental data are compared with the Fermi surfaces of tin. (auth)

28865 INTERACTION BETWEEN TITANIUM, ZIRCONIUM, AND HAFNIUM DIBORIDES AND CARBON. Yu. V. Levinskii and S. E. Salibekov. Zh. Neorgan. Khim., 10: 588-91(1965).

The solubility of C in Ti, Zr, or Hf diborides and the liquid-phase formation in diboride-carbon systems were studied. Diborides were synthesized from metal oxide, BC, and C or from metal and B, by compacting and sintering in vacuum at 1800°K for 1 hr. In contact with C, TiB_2 began to melt at about 2560°K, ZrB_2 at 2500°K, and HfB_2 at 2610°K. Only two phases, diboride and C, were found in TiB_2–C, ZrB_2–C, and HfB_2–C systems. Carbon solubility in Ti, Zr, and Hf diborides at high temperature is insignificant. The heating of mixtures of diborides with C at temperatures up to melting does not produce a new solid-phase formation; thus all three MeB_2–C systems are pseudobinary of a eutectic type. The eutectic temperatures are 2560°K for TiB_2–C, 2500°K for ZrB_2–C, and 2610°K for HfB_2–C; the diboride content in eutectic is 15, 19, and 24 mole %, respectively. Diboride parts in contact with graphite, as for instance high-temperature boride–graphite thermocouples, can be used successfully in service at temperatures up to 2500°K. (CFSTI)

28866 CALCULATION OF MADELUNG ENERGY OF LATTICES OF COMPLEX IONS. A. Neckel and G. Vinek (Universitat, Vienna). Z. Physik. Chem. (Frankfurt), 42: 129-44(1964). (In German)

A method for calculation of the Madelung energy of ionic crystals, based on the method of Ewald (Ann. Physik, 64: 253(1921), was developed for crystals whose ions are composed of several atoms. The charge distribution for a complex ion is replaced by a system of point charges so that the electrostatic lattice potential is developed in the form of a series corresponding to the development of a multipole. The method is used to calculate the Madelung energy of the following compounds crystallizing in the CaC_2 type: CaC_2, SrC_2, BaC_2, KO_2, SrO_2, and BaO_2. The following values are reported for SrC_2 and SrO_2, respectively: contribution of the nth derivative, n = 0, 1.683659, 1.649818; n = 2, −0.0271587, −0.0710682; n = 4, 0.00431574, 0.00731162; n = 6, 0.000241356, 0.000899291; $M_{a/2}$, 1.66106, 1.58696; U (kcal/mole), 759.045, 839.309. Two appendixes are given for development of the integrals I_n for the multipole development of $\Psi_{II}(r)$, and these are presented in tabular form. Evaluation of the terms for boundary condition ($r \rightarrow 0$) is given for even values of n; for n odd the terms are 0. (BBB)

28867 SHIFT OF THE CURIE TEMPERATURE IN GADOLINIUM DUE TO UNIFORM PRESSURE UP TO 35 KBARS. L. D. Livshitz and Yu. S. Genshaft (Inst. of Geophysics, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 48: 1050-3(Apr. 1965). (In Russian)

The pressure dependence of permeability was plotted at a constant temperature at a frequency of 500 cps and an effective field intensity of 5–6 oe. The pressure was applied through a silver chloride medium by the piston displacement method. The specimens were miniature toroids of polycrystalline metal turned from a cast stock of gadolinium with the following admixtures: Tb (0.1%), Ca (0.02%), Fe (0.01%), and Ce (0.005%). The temperature fluctuations during the experiment did not exceed 0.5–1°C. The pressure dependence curve of the Curie point was plotted on the basis of twelve independent determinations of the pressure points at which the specimen changed to the paramagnetic state. As expected this curve was a straight line with a proportionality factor of 1.34 ± 0.06 degrees per kbar. The mean deviation of the experimental points from the straight line was 0.8C in temperature and 0.6 kbar in pressure. A discontinuity of the curve within the 21–26 kbar pressure range of the curve, as described by Robinson and others (Phys. Rev.: 134, 1964, A187), was not observed. (ATD)

28868 ANOMALIES IN THE TEMPERATURE DEPENDENCE OF THE THERMAL EXPANSION COEFFICIENT OF A GADOLINIUM SINGLE CRYSTAL. Yu. V. Ergin (Moscow State Univ.). Zh. Eksperim. i Teor. Fiz., 48: 1062-4(Apr. 1965). (In Russian)

The thermal expansion coefficients of a gadolinium single crystal are measured along the a and c axes at temperatures between 78 and 330°K. A very complex nonmonotonous dependence of the thermal expansion coefficient α on temperature is observed along each of the two axes. Coefficient α is negative along the c axis in a broad temperature interval from 150°K up to the Curie point (290°K). Between 210–220°K the thermal expansion coefficient along the c axis is maximal; at the Curie point α is maximum along the a and c axes. (auth)

28869 HIGH-TEMPERATURE X-RAY INVESTIGATION OF URANIUM–OXYGEN AT $UO_{2.00}$–$UO_{2.40}$ INTERVAL. V. V. Rachev, L. M. Kovba, and E. A. Ippolitova (Moscow State Univ.). Zh. Neorgan. Khim., 10: 573-5 (Mar. 1965). (In Russian)

By the method of high-temperature x-ray radiography, the phase diagrams of the uranium–oxygen system in the interval $UO_{2.00}$ to $UO_{2.40}$ were investigated at 850 to 1150°C. It was established that the region of homogeneity of the phase UO_{2+x} slowly expanded from $UO_{2.19}$ at 850°C to $UO_{2.25}$ at 1150°C. The phase U_4O_{9+x} had a narrow region of homogeneity, changing very little with temperature. Between 1100 and 1150°C phase conversions of the order–disorder type originated. They were accompanied by an abrupt increase of the specific volume. The coefficients of linear expansion of the phases UO_{2+x} and U_4O_{9+x} were calculated for 850 to 1150°C. (tr-auth)

Radiation Effects

See also CHEMISTRY — Radiation Chemistry.

Refer also to abstracts 28575, 29612, 29613, and 29619.

28870 (BMI-X-10121) FISSION-FRAGMENT EFFECTS IN STRUCTURAL MATERIALS. Quarterly Progress Report, January–March 1965. Robert L. Ritzman, Neal M. Griesenauer, and Edward J. Jablonowski (Battelle Memorial Inst., Columbus, Ohio). Apr. 1, 1965. Work Performed under United States–Euratom Joint Research and Development Program. Contract W-7405-eng-92. 8p. (EURAEC-1370). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Typical microstructures of as-received and annealed Zircaloy-2 and Type 304 stainless steel for test specimen fabrication are shown. Initial bend specimens were tested to determine unirradiated control properties and reproducibility of results. It was found necessary to use a reduced gage section in the bend specimens (originally 3 by 0.50 by 0.01 in. thick) to produce a nominal amount of plastic strain while maintaining the specimen in pure bending. The first series of 0.005-in.-wall tube-burst specimens was prepared. Maximum wall-thickness variations of 0.0003 in. on the stainless steel specimens and 0.0002 in. on the Zircaloy-2 specimens were measured. A parallel series of 0.010-in.-wall tube-burst specimens is being prepared in the event of nonreproducibility of tube-burst data from the 5-mil-wall specimens. (J.R.D.)

28871 (EURAEC-1347) ON THE EFFECT OF NITROGEN INTERSTITIALS ON THE RADIATION EMBRITTLEMENT OF PURE IRON. Technical Report No. 3. M. Castagna, R. L. Colombo, A. Ferro, F. S. Rossi, and G. Szabo (Società Ricerche Impianti Nucleari, Sluggia (Italy), Centro Ricerche Nucleari). Mar. 1965. Work Performed under United States–Euratom Joint Research and Development Program. Contract 004-63-10-TEEI. 37p. (EUR-2322) Dep.(mn); $2.00(cy), 1(mn) CFSTI.

Preliminary experiments on the radiation damage of two iron materials were performed. One of these materials was Armco iron re-melted in vacuo and added with nitrided iron in a nitrogen atmosphere and with silicon as a deoxidizer, so that the final nitrogen content was about 0.02 wt %. The other material, used for reference, was Armco iron re-melted in vacuo and added with 0.25 wt % titanium, with the purpose, besides deoxidation, of removing all of the nitrogen and carbon interstitials, which precipitate as titanium nitrides and carbides. This material shows no ageing at all and has no sharp yield point. Both materials were hot-worked below 750°C, cold rolled to several different R.A.'s and fully annealed at 820°C in vacuo or nitrogen atmosphere. Average grain size ranged from 6 to 6.5 ASTM grain size, yield point (for nitrogen-enriched iron) was 22 kg/mm², 0.2% proof stress (for interstitial-free iron) was 10.5 kg/mm². Irradiation was performed in the SORIN–RS1 swimming pool reactor in Saluggia at a temperature not exceeding 50°C and to an integrated fast neutron (>1 Mev) flux of about 1.4×10^{19} n/cm². V-notch impact tests were performed on specimens both prior and after irradiation and the change in the ductile-brittle transition temperature was determined. The transition temperature for nitrogen-containing iron was about 0°C prior to irradiation and about 160°C after irradiation, while in interstitial-free iron it shifted from –60° to 0°C. While the absorbed energy above the transition temperature is in this latter material practically unchanged by radiation, in nitrogen-containing iron it drops to about one half of its original value. (auth)

28872 (GEST-2039) RESEARCH PROGRAM FOR THE LONG TERM TESTING OF CYLINDRICAL DIODES AND THE IRRADIATION OF FUEL AND INSULATOR. Fifth Quarterly Summary Report. (General Electric Co., Pleasanton, Calif. Special Purpose Nuclear Systems Operation). Sept. 17, 1964. Contract NAS 3-2544. 56p. (NASA-CR-54267, N65-19263). $3.00(CFSTI).

The experimental and analytical work in nuclear thermionics for long term testing of cylindrical diodes and the irradiation of fuel and insulator are presented. The work consists of development of basic converter life, thermal and irradiation testing of fuel-clad emitter, and irradiation of high purity alumina at temperature. (L.B.S.)

28873 (TID-21874) EFFECTS OF ATOMIC IRRADIATION AND OF MOLECULAR ORIENTATION ON THE MECHANICAL BEHAVIOR OF LINEAR HIGH POLYMERS. Final Technical Report. C. C. Hsiao (Minnesota Univ., Minneapolis). Feb. 1965. Contract AT(11-1)-532. 143p. Dep.(mn); $4.00(cy), 3(mn) CFSTI.

An attempt is made to correlate the macroscopic phenomenological and molecular theories of mechanical properties of some polymeric solids. The mathematical model which is developed is shown to have predictive value. The effects of orientation and radiation on anisotropy, strength, and fracture are analyzed and described. (D.L.C.)

28874 (AD-610971) GROWTH AND COALESCENCE OF CRYSTALS UNDER THE INFLUENCE OF IONIZING RADIATIONS. M. L. Baskin and A. A. Semerchan. Translated by E. R. Hope from Vestn. Akad. Nauk SSSR, 1: 69-70(1958). 4p. (T-290-R; TT-59-15266). $1.00(fs); $0.50(mn) CFSTI.

In the formation of aluminum oxide crystals from metallic aluminum and oxygen, the oxygen, in spite of refrigeration, penetrates relatively quickly through the aluminum oxide layer to the metal. Irradiation increases the rate of diffusion. Irradiation with electrons and x rays at particle energies of the order of 1 Mev not only promotes the occurrence of all chemical reactions, but also increases the rate of diffusion and the rate of crystal growth. (CFSTI)

28875 (AI-Trans-75) THE INFLUENCE OF α IRRADIATION AT LOW TEMPERATURE ON THE INTERNAL FRICTION OF SUPERPURITY COPPER. D. Koenig, J. Voelkl, and W. Schilling. Translated by Anthony Cornell (Atomics International, Canoga Park, Calif.), from Phys. Status Solidi, 7: 577-90(1964). 19p. Dep.(mn); $1.60(fs), $0.80(mf) JCL.

Copper foils (99.999% purity) 5μm thick and about 6mm long and 2mm wide firmly fastened at one end were irradiated at about 30°K with α particles from a ^{210}Po source, and then excited to transverse oscillations. The internal friction was determined from the decrease of the amplitude. It was found that α irradiation at first almost completely suppresses the Bordoni peak. It reappears only slowly again annealing at temperatures above 125°K, but does not reach its original height again even after heating to about 400°K. Rather, it becomes smaller after each irradiation and recovery cycle. The familiar secondary peak fails to reappear after the first irradiation. A series of peaks (at about 39°K, 104°K, 170°K, and 240°K) are produced by the irradiation and may probably be explained by the interaction of dislocations with point defects. (auth)

28876 THE INFLUENCE OF NEUTRON IRRADIATION ON THE PRECIPITATION KINETICS OF A SUPERSATURATED Al–Cu ALLOY. G. Vogl and B. Weiss (Universität, Vienna). Acta Met., 13: 578-82(May 1965). (In German)

The effects of neutron irradiation on the precipitation kinetics of an Al alloy with 5.17 at. % Cu were determined by measurement of the electric resistance. The precipitation behavior at tempering temperatures from 160 to 220°C was determined after irradiation doses of 10^{18} n/cm^2. The precipitation was strongly dependent on temperature. In the second series the tempering temperature was 200°C after irradiation with neutron doses of 10^{16}, 10^{17}, 3×10^{17}, 10^{18}, 3×10^{18}, and 10^{19} n/cm^2. Above a neutron dose of about 10^{17} a significant acceleration of the precipitation occurred. There was no difference in the activation energy of the irradiated and nonirradiated samples. The time behavior of the isothermal decomposition is discussed. (J.S.R.)

28877 USE OF ANODIZED IRRADIATION CAPSULES IN SWIMMING POOL REACTORS. V. Schneider. Aluminium, 39: 628-9(1963). (In German)

To prevent the decoloration of irradiation capsules, the possibility of using anodized aluminum capsules was investigated. Treated and nontreated capsules were irradiated and compared. The results show that the use of anodized capsules can be advantageous although a possible contamination of the irradiation material by aluminum is to be avoided. (J.S.R.)

28878 STUDIES OF ELASTIC MODULUS OF IRRADIATED GRAPHITE BY AN ULTRASONIC PULSE METHOD. S. Sato and S. Miyazono (Japan Atomic Energy Research Inst., Tokyo). Carbon, 2: 103-14(Oct. 1964).

An ultrasonic technique for studies of the modulus of elasticity was developed in order to provide nondestructive testing of the mechanical strength of reactor graphite. The graphite types used in these tests were: extruded TAG-1, press-molded TAG-2, both made from Lockport coke, and press-molded TAG-3, made from pitch coke. All three graphites were produced by the Tokai Electrode Manufacturing Company. Irradiations were performed at Hanford in helium-filled aluminum capsules with total doses of 5.8×10^{20} nvt at 30°C, and of 7.2×10^{20} nvt (total) at 80°C. The elastic modulus and mechanical strength were measured for all three types of graphite at room temperature and the results compared. A close correlation was found to exist between the two properties, indicating the possibility of estimating mechanical strength from elastic modulus irrespective of irradiation dose. Recovery of original elastic properties in thermal annealing was studied by measuring the elastic modulus during isochronal and isothermal annealing. For that end the ultrasonic technique was modified to permit measurements at high temperature. (auth)

28879 ANOMALOUS STORED ENERGY AND c-AXIS CHANGES IN ALTERNATELY IRRADIATED AND ANNEALED GRAPHITE. Donald G. Schweitzer and Robert M. Singer (Brookhaven National Lab., Upton, N. Y.). Carbon, 2: 185-91(1964).

Stored energy releases in graphites exhibiting normal and enhanced dimensional changes indicate that the change in rate of dimensional expansion after large neutron irradiations is due to a change in apparent defect volume and is not due to a change in the rate of accumulation of defects. Reverse stored energy annealing experiments are correlated with the reverse c-axis annealing experiments. The assumption that interstitials anneal to sinks rather than to vacancies can be used to explain these data. The nature of the annealing reactions producing stored energy releases is discussed. (auth)

28880 FAULT-IMPURITY INTERACTION IN FUSION-ZONE IRON POLLUTED WITH NICKEL AND IRRADIATED WITH FAST NEUTRONS AT 77°K. Pierre Vigier, Vital Hivert, Pierre Moser, and Emmanuel Bonjour (Centre d'Etudes Nucleaires, Grenoble, France). Compt. Rend., 260: 3359-62(Mar. 22, 1965). (In French)

The effects of nickel traces in iron irradiated with fast neutrons at 77°K were studied by release of stored energy, internal friction, and magnetic training. New faults were detected. One was attributed to an interstice–nickel interaction, and the other to a di-interstice–nickel interaction. (tr-auth)

28881 THE EFFECTS OF STEADY-STATE REACTOR RADIATION ON THIN MAGNETIC FILMS. W. D. Miller and D. I. Norman (UNIVAC Div. of Sperry Rand Corp., Saint Paul, Minn.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 450-6(Feb. 1965).

The effects of steady-state reactor radiation on thin magnetic films were studied experimentally. Radiation effects were characterized in terms of changes in the magnetic properties of films at several flux levels. The nature of changes in solid-state structure was studied by means of x-ray diffraction and electron microscopy. Changes in magnetic properties are discussed as a function of physical damage to the films. The influence of coatings applied to the films to prevent non-nuclear damage is evaluated. Radiation-induced changes are compared to changes induced by annealing similar films in air. An explanation for observed differences in the extent of damage as a function of coating material is suggested. (auth)

28882 INVESTIGATIONS ON THE INFLUENCE OF ENERGY-RICH RADIATION ON THE DIELECTRIC PROPERTIES OF POLYVINYL CHLORIDE. D. Kiessling (Institut fur Physik und Physikalische Chemie der Hochpolymeren, Deutsche Akademie der Wissenschaften, Leipzig). Kolloid-Z., 201: 62-4(Jan. 1965). (In German)

The radioinduced cross-linking of polyvinyl chloride was examined using the change in molecular weight distribution, and above the gel dose (14.6 MRad), the gel-sol content. Below the gel dose, the extremum of the molecular weight distribution moved to higher molecular weight with increasing dose; small molecules formed by fragmentation also appeared. Linked material swelling capability decreased rapidly; extractable material decreased rapidly and had very low molecular weight. The ratio of chain

ruptures to chain formations was found to be 0.11. Powdered samples had a dependence on the atmosphere, compact samples did not. The latter also had much less HCl loss because of the low diffusibility of HCl in polyvinyl chloride. Thus a high conductance in solid material was found. Elimination of relaxation losses was particularly difficult at high temperatures. A table of activation energies is given. Dielectric behavior in the region of the α relaxation dependence showed a shift to lower frequencies; with increasing cross-linking the region again shifted to higher frequencies. Below 40°C one shift to higher frequencies was observed; temperature regions showed equivalent shifts if the temperature was varied. (TCO)

28883 DYNAMICS OF RADIATION DAMAGE IN A BODY-CENTERED CUBIC LATTICE. II. HIGHER ENERGIES. C. Erginsoy, G. H. Vineyard, and A. Shimizu (Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 139: A118-25(July 5, 1965). (BNL-8857)

Computer studies in the dynamics of radiation damage in a body-centered cubic lattice representing α iron are extended to knock-on energies up to 1500 ev. The mean number N_d of defects created is calculated first for a knock-on of 100 ev in a large variety of directions. In one representative direction the knock-on energy is varied up to 1500 ev. It is seen that N_d increases approximately linearly with knock-on energy E. The usual formula $N_d = E/2E_d$ can be used with an effective threshold energy E_d of 50 to 55 ev. Dynamic features of a single collision and a cascade of collisions are investigated. The free-atom binary model is not adequate for a single collision for the purpose of estimating the transfer of kinetic energy. In a cascade, the initially localized kinetic energy of the knock-on is seen, in a relatively short time, to divide into equal amounts of potential energy in the lattice and total kinetic energy of moving atoms. The process of channeling of an iron atom projected into the lattice along a low-index direction is studied with the same model. The range of the channeled atom is found to be proportional to the $\frac{3}{2}$ power of its initial energy, in disagreement with the predictions of the impulse approximation and in agreement with recent experiments. (auth)

28884 VARIATIONS OF THE STORED-ENERGY DISTRIBUTIONS IN RE-IRRADIATED NUCLEAR GRAPHITES. Donald G. Schweitzer and Robert M. Singer (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 8: 1(May 1965).

28885 IRRADIATION EMBRITTLEMENT OF STAINLESS STEEL AT VERY HIGH TEMPERATURES. W. R. Martin and J. R. Weir (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 2-3(May 1965).

28886 THE INFLUENCE OF CROSS-SECTIONAL SHAPE UPON IRRADIATION-INDUCED STRESSES IN GRAPHITE COMPONENTS. F. J. Witt and B. L. Greenstreet (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 3-4(May 1965).

28887 THE EFFECTS OF NEUTRON IRRADIATION ON THE CREEP-RUPTURE PROPERTIES OF MOLYBDENUM. J. Moteff and F. D. Kingsbury (General Electric Co., Cincinnati). Trans. Am. Nucl. Soc., 8: 5(May 1965).

28888 ABSOLUTE NUMBER OF DEFECT CLUSTERS PRODUCED IN NEUTRON-IRRADIATED α-IRON PER UNIT EXPOSURE. J. R. Beeler, Jr. (General Electric Co., Cincinnati). Trans. Am. Nucl. Soc., 8: 5-6(May 1965).

28889 INFLUENCE OF NEUTRON IRRADIATION ON THE TENSILE PROPERTIES OF THE ALUMINUM ALLOY 6061. H. E. McCoy and J. R. Weir (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 6-7(May 1965).

28890 ELECTRON MICROSCOPE OBSERVATION OF THE FISSION-GAS BUBBLE DISTRIBUTION IN UO_2. A. D. Whapham (United Kingdom Atomic Energy Authority, Harwell, Berks, Eng.). Trans. Am. Nucl. Soc., 8: 21-2(May 1965).

28891 FISSION-GAS RELEASE DURING FISSIONING IN UO_2. R. M. Carroll (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 22(May 1965).

28892 A DYNAMIC METHOD FOR IN-PILE FISSION-GAS-RELEASE STUDIES. R. B. Perez (Univ. of Florida, Gainesville). Trans. Am. Nucl. Soc., 8: 22-3(May 1965).

28893 IRRADIATION BREWING OF UO_2. G. R. Horn, J. L. Bates, and D. R. de Halas (Battelle-Northwest, Richland, Wash.). Trans. Am. Nucl. Soc., 8: 23-4(May 1965).

28894 ENGINEERING FOR THE FISSION GAS IN UO_2 FUEL. W. Bennett Lewis (Atomic Energy of Canada Ltd., Chalk River, Ont.). Trans. Am. Nucl. Soc., 8: 24(May 1965).

28895 THE EFFECT OF UO_2 DENSITY ON FISSION-PRODUCT GAS RELEASE AND SHEATH EXPANSION. M. J. F. Notley and J. R. MacEwan (Atomic Energy of Canada Ltd., Chalk River, Ont.). Trans. Am. Nucl. Soc., 8: 25(May 1965).

28896 EMANATION OF XENON AND KRYPTON FROM OXIDE FUELS DURING REACTOR OPERATION. Howard S. Dreyer (Lockheed Missiles and Space Co., Sunnyvale, Calif.). Trans. Am. Nucl. Soc., 8: 25-6(May 1965).

28897 THE EFFECTS OF COMPATIBILITY ON THE PERFORMANCE OF ALUMINUM FUEL PLATES CONTAINING VARIOUS FUEL DISPERSIONS. M. J. Graber and R. A. Moen (Phillips Petroleum Co., Idaho Falls, Idaho). Trans. Am. Nucl. Soc., 8: 31(May 1965).

28898 COMPARATIVE IRRADIATION PERFORMANCE OF PELLET AND VIBRATORY COMPACTED UO_2. M. G. Balfour and H. M. Ferrari (Westinghouse Electric Co., Pittsburgh). Trans. Am. Nucl. Soc., 8: 34-5(May 1965).

28899 AN EVALUATION OF UO_2 IRRADIATED AT 1600 TO 2400°C. C. Michelson (Tennessee Valley Authority, [Oak Ridge]). J. L. Scott, and E. L. Long, Jr. Trans. Am. Nucl. Soc., 8: 37(May 1965).

28900 THERMAL CONDUCTIVITIES OF FUELED GRAPHITE SPHERES FROM IRRADIATION TEST DATA. J. W. Prados (Univ. of Tennessee, Knoxville), V. A. DeCarlo, and J. L. Scott. Trans. Am. Nucl. Soc., 8: 37-8 (May 1965).

28901 POST-IRRADIATION EXAMINATION OF HIGH-BURNUP MOLTEN UO_2 FUEL RODS. M. F. Lyons, B. Weidenbaum, R. F. Boyle, and T. J. Pashos (General Electric Co., Pleasanton, Calif.). Trans. Am. Nucl. Soc., 8: 42-3(May 1965).

28902 IN-PILE VOID MIGRATION IN URANIUM DIOXIDE. J. A. Christensen (Westinghouse Electric Co., Pittsburgh). Trans. Am. Nucl. Soc., 8: 44-5(May 1965).

28903 THE LONGITUDINAL AND DIAMETRAL EXPANSIONS OF UO_2 FUEL ELEMENTS. M. J. F. Notley, A. S. Bain, and J. A. L. Robertson (Atomic Energy of Canada Ltd., Chalk River, Ont.). Trans. Am. Nucl. Soc., 8: 94-5(May 1965).

28904 PERIODICAL RADIATION AND CREEP ANALYSIS FOR CYLINDRICAL FUEL ELEMENTS. Benjamin M. Ma (Iowa State Univ., Ames). Trans. Am. Nucl. Soc., 8: 95-6(May 1965).

28905 STRUCTURAL ANALYSIS OF A REACTOR SUBASSEMBLY UNDER THERMAL, HYDRAULIC, AND FUEL-EXPANSION LOADS. C. M. Friedrich (Westinghouse Electric Co., West Mifflin, Pa.). Trans. Am. Nucl. Soc., 8: 96-7(May 1965).

28906 EFFECTS OF IRRADIATION ON THE ELEVATED-TEMPERATURE MECHANICAL PROPERTIES OF AUSTENITIC STEELS. P. C. L. Pfeil and D. R. Arkell

(Atomic Energy Research Establishment, Harwell, Berks, Eng.). Trans. Am. Nucl. Soc., 8: 120(May 1965).

28907 URANIUM CARBIDE TRANSIENT-HEATING STUDIES— PHASE II. S. J. Stachura, R. N. Cordy, and M. Silberberg (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 8: 305(May 1965).

28908 EFFECT OF PRELIMINARY IRRADIATION WITH PROTONS ON THE FUNCTIONING OF A POROUS NICKEL ELECTRODE. A. M. Bograchev, P. I. Dolin, and D. V. Kokoulina (Inst. of Electrochemistry, Academy of Sciences, USSR). Zh. Fiz. Khim., 39: 497-8(Feb. 1965). (In Russian)

The effects of the increase of the electrochemical activity of porous nickel electrodes under the effect of preliminary proton irradiation with respect to ionization reactions of hydrogen were determined. (tr-auth)

28909 CHARGED PARTICLE RADIATION EFFECTS ON SELECTED TRANSPARENT MATERIALS FOR AEROSPACE ENCLOSURES. J. L. Chinn, N. M. Ewbank, and G. Gigas (Atomics International, Canoga Park, Calif.). 8p. (CONF-617-21)

From Special Technical Conference on Nuclear Radiation Effects, Seattle, July 1964.

Optical transmission spectra of selected transparent dielectric materials subjected to charged particle irradiations in the 0.3- to 160-Mev energy range with integrated proton and electron fluxes of 10^{11} to 10^{15} particles/cm^2 are reported in the wavelength region of 200 to 1600 millimicrons. Spectrophotofluorometric scanning measurements are presented of the temperature dependence of radiation-induced thermoluminescence of selected materials in the 200- to 800-millimicron region. (auth)

28910 LOW TEMPERATURE GRAPHITE RADIATION DAMAGE REMOVAL. D. G. Schweitzer, R. M. Singer, and D. H. Gurnsky (to U. S. Atomic Energy Commission). U. S. Patent 3,183,166. May 11, 1965.

A method is given for the removal of radiation damage from graphite. The graphite is alternately heated at low temperatures and irradiated for short time intervals. This prevents the accumulation of large amounts of Wigner growth and large potentially destructive amounts of stored energy in the graphite while eliminating the heretofore known oxidation of moderator graphite during annealing at high temperatures, thus providing long moderator graphite operating lifetime. Provision is also made for excess radiation damage removal, whereby large amounts of dimensional growth can be removed from graphite that has been irradiated over long periods of time, and whereby the graphite can be returned substantially to its original or unirradiated dimensions. (AEC)

METEOROLOGY

See also GEOLOGY AND MINERALOGY — Site Survey and Selection.

28911 THE SIZE SPECTRA OF NATURAL ATMOSPHERIC AEROSOLS. M. Gass, M. Saran, and K. Stierstadt (Universitat, Munich). Z. Physik, 85: 269-77(1965). (In German)

The size distribution of natural occurring aerosol particles with a radius between 10^{-5} and 10^{-6} cm was measured simultaneously by two different methods: Firstly the measurement of the current, caused by the natural distribution of electric charges on the particles, which move along the axis of a cylindrical condenser; secondly the distribution of thoron decay products on the size spectrum of the aerosol. Both methods have their maximum sensitivity in different regions of the size spectrum. The distributions obtained with the two methods are in rather good agreement. The small deviation of the two spectra is ascribed to systematic differences of the measuring methods. (auth)

PHYSICS

General

28912 (ANL-6819) PHYSICS DIVISION SUMMARY REPORT, SEPTEMBER–DECEMBER 1963. (Argonne National Lab., Ill.). Contract W-31-109-eng-38. 61p. Dep.(mn); $3.00(cy), 2(mn) CFSTI.

New data on electronic g factors for metastable states and magnetic dipole hyperfine-interaction constants for stable isotopes of Fe, Ge, and Sn are reported. Work aimed at determining molecular fragmentation kinetic energy distribution by moment analysis are described, and findings for the fragmentation of CH_4, H_2O, and CO are given. The fact that the distributions usually peak strongly at zero kinetic energy precludes the possibility of a Boltzmann distribution of the usual type. The sum of a repulsive and an attractive Yukawa nucleon-nucleon potential is fitted to the low-energy scattering parameters. Their relative strength is determined by a saturation condition. The computed singlet s-wave phase shifts up to 310 Mev agree with the experimental values. The amplitude for two-particle scattering may be computed by inverting a Hilbert-space operator (1 – K), where K is completely continuous and depends on the real energy as a parameter. The operator K may be approximated by a finite matrix to any desired degree of accuracy. When elementary particle interactions are renormalizable and CP invariant, as a result of parity-nonconserving interactions, it is proved that any spin-$\frac{1}{2}$ particle should have pseudoscalar charge density as well as the usual scalar charge density, and the pseudoscalar charge density is an observable. The ω and ϕ vector mesons were described in the unitary-symmetry theory as mixtures of singlet and octet components. A dynamical basis for the mixing of the singlet and octet components was suggested which also explains the weak coupling between the physical ϕ meson and pion decay and production channels. (J.R.D.)

28913 (CNAEM-22) PROPAGATION OF PLANE WAVES IN AN ELASTIC MEDIUM WITH COUPLE STRESS. E. S. Suhubi (Cekmec Nuclear Research Center, Atomic Energy Commission, Istanbul (Turkey)). Feb. 1965. 28p. Dep.(mn).

The propagation of plane waves in a microelastic medium having only couple stress is studied. The fundamental field equations are first written in a vectorial form, then they are partitioned into simpler systems by assuming field variables as the sum of the irrotational and solenoidal vectorial fields. After having cast the equations into a suitable form the plane wave solutions are sought, and it is shown that six type of waves, which travel from different velocities, can exist in such a medium. All waves, with the exception of longitudinal displacement waves appear to possess a dispersive character. It is shown that a cut-off frequency exists for one kind of rotation and one kind of displacement waves. Finally a formal solution of the equations is given for an infinite medium by making use of fourier transforms. (auth)

28914 (FZK-197) A CONSISTENT-VIBRATIONS MODEL OF THE INTERNAL DYNAMICS OF LIQUID HYDROGEN. H. G. Carter (General Dynamics/Fort Worth, Tex.). Mar. 1965. Contract AF29(601)-6213. 68p. (WL-TR-64-162)

A model describing the internal dynamics of a nonassociated liquid was constructed for use in the calculation of cold-neutron scattering cross sections and free-radical recombination rates in liquid hydrogen. The proposed model assumes that the specification of a given temperature and density implies a quiescent state in which each molecule vibrates with random phase in a field set up by the sum of the position probability densities of its neighbors, the central sites of which comprise a close-packed quasi-lattice. A computer program was written to calculate the consistent vibration frequency, the molecular well depth, the internal energy, the entropy, and the free energy of a liquid with a given temperature and density and with known Lennard-Jones parameters of the intermolecular interaction. Application of the program to the case of liquid hydrogen at points on the P-V-T surface ranging from 20 to 28°K along the saturation line has given predictions of thermodynamic properties which are in good agreement with experimental data. It is tentatively concluded that the model anticipates the most significant general features of motion in the liquid and may be implemented in calculations of cross sections and recombination rates which are dependent on the details of the internal dynamics and microscopic structure. (auth)

28915 (INR/517/I/PL) EXPERIMENTAL NUCLEAR PHYSICS AT THE WARSAW CENTRE IN THE YEARS 1945–63. Z. Wilhelmi (Institute of Nuclear Research, Warsaw (Poland)). Apr. 1964. 40p. Dep.

The development of the low energy nuclear physics is described. The list of papers published in the period 1950–1963 by the coworkers of the Nuclear Physics Chair, Warsaw University, and of the I and I-A Laboratories of the Institute for Nuclear Research, Warsaw is included. (auth)

28916 (IPPJ-31) ELECTROMAGNETIC SHOCK WAVE IN A TRANSPARENT MEDIUM. Kazunari Ikuta and Tosiya Taniuti (Institute of Plasma Physics, Univ. of Nagoya (Japan)). Nov. 1964. 13p. Dep.(mn).

The electromagnetic wave propagation in a simple model of a dielectric medium which is characterized by a nonlinear relation between the electric displacement and the electric field strength is considered. The formation of shock-like discontinuity is shown by the method of characteristics, and the jump relations across such a discontinuity are derived corresponding to the Rankine-Hugoniot relation in gas dynamics. Then, it is shown that the evolutionary condition enables the selection of a physically relevant solution among others admissible by the jump relations. (auth)

28917 (LNF-64/69) ATTIVITA' DEI LABORATORI NAZIONALI DI FRASCATI DAL 1 LUGLIO 1963 AL 30 GIUGNO 1964. (Activity of the Frascati National Laboratory from July 1, 1963–June 30, 1964). Note No. 14. (Laboratori Nazionali di Frascati, Comitato Nazionale per l'Energia Nucleare (Italy)). Dec. 1964. 26p. Dep.(mn).

Study and experimentation in fundamental nuclear physics is the principal objective of the Frascati National Laboratories. Particular emphasis is placed upon the field of elementary particles. Until now most of the experimental work has been carried out on the 1100-Mev electron, synchrotron. The continual improvement and the extension of its capability is an important activity of the Laboratories. The design and construction of a large storage ring for colliding beams of electrons and positrons is another important project. The maximum energy shall be 1500 Mev for each beam. This storage ring will lead to the development of a new and important area of research in elementary particles. A linear electron accelerator, having an energy of 450 Mev, which serves as the injector of the storage ring, shall also be used directly in the study of nucleon structure and to create an intense medium energy pion beam. Fundamental research in different fields of physics is encouraged and supported. Research activities include low temperature physics, solid state physics, electronics and instrumentation. In connection with the synchrotron and the new projects the Laboratories also conduct research in instrumentation and into technical problems. This leads to the development of new equipment that serves at the experimental facility. The scientific and technical activities of the Frascati National Laboratories are divided in the following groups: High energy nuclear physics group, Adone project group (storage ring), LEALE group (linear accelerator), Machine group, Cryogenics group, Magnetic mea-

surements group, Electronics group, Technological group, Health physics group, Computing group, and the Theoretical group. (auth)

28918 (MLM-1189(Suppl.)) SHOCK TUBES: A BIBLIOGRAPHY (SUPPLEMENT I). Arnold M. Melnick (Mound Lab., Miamisburg, Ohio). Mar. 10, 1964. Contract AT-33-1-GEN-53. 10p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

A total of 65 classified reports are listed. Author and subject indexes are included. (D.L.C.)

28919 (NP-14913) THE INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS INTERIM REPORT, ACADEMIC YEAR 1964–1965. (International Centre for Theoretical Physics, Trieste (Italy)). Mar. 1965. 16p. Dep.(mn).

The inception of the International Centre for Theoretical Physics, the research activities of this center, and the papers published by the center are reviewed. 42 references. (T.F.H.)

28920 (UCRL-7785-T) FRESNEL ZONE PLATES FOR FOCUSING MICROWAVES. Ronald S. Hawke (Lawrence Radiation Lab., Univ. of California, Livermore). Jan. 7, 1964. Contract [W-7405-eng-48]. 24p. Dep.(mn); $1.00 (cy), 1(mn) CFSTI.

The operation of simple Fresnel zone plates is described. The procedure for designing half-wavelength and quarter-wavelength Fresnel zone lenses is given. The procedure was used to construct a quarter-wavelength lens for 35 and 70 Gc. Calculations of expected gain are made and compared with measured values. The reduced gain caused by spherical waveforms incident on a lens designed for planar waves and two methods of compensating for spherical wavefronts are derived. (M.J.T.)

28921 (UCRL-7895) STABILITY OF A SPHERICAL GAS DETONATION. R. E. Duff, M. Finger, and N. Manson (Lawrence Radiation Lab., Univ. of California, Livermore). May 20, 1964. Contract W-7405-eng-48. 5p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

The question of instability in linear gas detonations was investigated by observing a spherically expanding wave which was completely independent of edge effects. The soot patterns obtained by detonation of acetylene–oxygen mixtures in a can were indistinguishable from those obtained in linear detonations, indicating that the instability is intrinsic and not caused by linear one-dimensional geometry. (D.L.C.)

28922 ONE GROUP OF SOLUTIONS FOR THE MAGNETOHYDRODYNAMIC EQUATIONS. A. G. Khantadze (Inst. of Geophysics, Academy of Sciences, Georgian SSR). Geomagnetizm i Aeronomiya, 5: 167-70(Jan.-Feb. 1965). (In Russian)

Magnetohydrodynamic equations for ideal conducting media are correlated for resolving problems of ordinary hydrodynamics. (R.V.J.)

28923 QUANTUM SECOND VIRIAL COEFFICIENT OF A TWO-DIMENSIONAL LENNARD-JONES GAS. John R. Sams (Univ. of British Columbia, Vancouver). Mol. Phys., 9: 17-27(1965).

The equation of state of a dilute two-dimensional quantum degenerate gas at moderately high temperatures is considered, and the second virial coefficient is calculated, assuming a Lennard-Jones function for the pair potential. The physical systems of interest are the mobile adsorption of gases on solid surfaces at low surface densities. The net Slater sum corrections to the classical B are smaller than for the three-dimensional case, whereas the effect of different particle statistics is enhanced. This leads to markedly different results in the two-dimensional problem. (auth)

28924 QUANTUM SECOND VIRIAL COEFFICIENT OF A ONE-DIMENSIONAL LENNARD-JONES GAS. John R. Sams (Univ. of British Columbia, Vancouver). Mol. Phys., 9: 77-85(1965).

The equation of state of a dilute one-dimensional quantum degenerate gas at moderately high temperatures is considered, and the second virial coefficient is calculated assuming a Lennard-Jones function for the pair potential. Comparison with similar results for two- and three-dimensional gases reveals definite trends with changes in dimensionality. The Slater sum treatment of the quantum defects is found to be applicable over a narrower range of reduced temperatures as the dimensionality decreases. (auth)

28925 ENERGY DISSIPATION OF ELECTRONS AT IMPURITIES IN NORMAL METALS. Shigeharu Koshino (Niigata Univ., Japan). Progr. Theoret. Phys. (Kyoto), 33: 154-5(Jan. 1965).

The energy loss of electrons in inelastic scattering due to the thermal motion of charged impurities is calculated and compared with the energy loss due to electron-phonon interaction. (D.C.W.)

28926 TRANSACTIONS OF THE AMERICAN NUCLEAR SOCIETY 1965 ANNUAL MEETING, JUNE 21-24, 1965, GATLINBURG, TENNESSEE. Trans. Am. Nucl. Soc. 8: 1-312(May 1965).

Summaries of the 356 papers presented are included. (C.E.S.)

For titles of individual papers see: 28254, 28255, 28256, 28257, 28258, 28259, 28260, 28326, 28327, 28328, 28329, 28357, 28408, 28409, 28450, 28451, 28452, 28482, 28513, 28514, 28515, 28520, 28553, 28567, 28619, 28620, 28621, 28682, 28683, 28684, 28685, 28686, 28687, 28688, 28689, 28690, 28691, 28692, 28703, 28715, 28716, 28719, 28720, 28721, 28722, 28745, 28746, 28747, 28748, 28762, 28763, 28764, 28765, 28766, 28767, 28768, 28769, 28770, 28771, 28788, 28789, 28790, 28791, 28792, 28844, 28845, 28846, 28847, 28848, 28849, 28850, 28851, 28852, 28853, 28854, 28855, 28856, 28857, 28858, 28859, 28860, 28884, 28885, 28886, 28887, 28888, 28889, 28890, 28891, 28892, 28893, 28894, 28895, 28896, 28897, 28898, 28899, 28900, 28901, 28902, 28903, 28904, 28905, 28906, 28907, 28927, 28972, 29022, 29023, 29024, 29025, 29026, 29027, 29035, 29126, 29154, 29187, 29188, 29189, 29190, 29191, 29192, 29193, 29194, 29195, 29196, 29197, 29198, 29199, 29200, 29201, 29202, 29203, 29204, 29205, 29206, 29207, 29208, 29209, 29210, 29211, 29212, 29213, 29214, 29215, 29216, 29217, 29218, 29219, 29313, 29314, 29315, 29316, 29317, 29318, 29319, 29320, 29321, 29322, 29323, 29324, 29325, 29326, 29327, 29328, 29329, 29330, 29331, 29332, 29333, 29334, 29335, 29336, 29337, 29338, 29339, 29427, 29428, 29444, 29445, 29446, 29447, 29448, 29449, 29450, 29451, 29452, 29453, 29454, 29455, 29456, 29457, 29458, 29459, 29460, 29461, 29462, 29474, 29475, 29481, 29482, 29514, 29515, 29516, 29517, 29518, 29519, 29520, 29521, 29522, 29523, 29524, 29525, 29526, 29527, 29528, 29529, 29530, 29531, 29532, 29533, 29534, 29535, 29536, 29537, 29538, 29539, 29540, 29541, 29542, 29543, 29544, 29545, 29546, 29547, 29548, 29549, 29550, 29551, 29552, 29553, 29554, 29555, 29556, 29557, 29558, 29559, 29560, 29561, 29562, 29563, 29564, 29565, 29566, 29567, 29568, 29569, 29570, 29571, 29572, 29573, 29574, 29578, 29579, 29580, 29588, 29589, 29590, 29591, 29592, 29593, 29594, 29595, 29596, 29597, 29598, 29654, 29655, 29656, 29657, 29658, 29659, 29660, 29661, 29662, 29663, 29664, 29665, 29666, 29667, 29668, 29669, 29670, 29671, 29672, 29673, 29674, 29675, 29676, 29677, 29678, 29679, 29680, 29681, 29682, 29683, 29684, 29685, 29686, 29687, 29688, 29689, 29690, 29691, 29692, 29693, 29694, 29695, 29696, 29720, 29721, 29722, 29723, 29724, 29725, 29726, 29727, 29728, 29729, 29756, 29757, 29758, 29759, 29760, 29761, 29762, 29763, 29764, 29765, 29766, 29767, 29768, 29769, 29770, 29771, 29772, 29773, 29790, 29791, 29792, 29793, 29794, 29795, 29796, 29797, and 29804.

28927 DIGITAL COMPUTER ANALYSIS OF BETA-RAY SPECTRA IN DUAL-LABEL ISOTOPE STUDIES. John H. Nodine, David Winstin, Donald Ware, and Joseph M. Platt (Hahnemann Medical Coll. and Hospital, Philadelphia). Trans. Am. Nucl. Soc., 8: 62-3(May 1965).

28928 ELECTROMAGNETIC OSCILLATIONS IN A RESONANCE MEDIUM. A. I. Alekseev (Inst. of Engineer-

ing Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 48: 879-89(Mar. 1965). (In Russian)

Electromagnetic oscillations are investigated for a resonance medium consisting of identical two-level molecules; pumping and relaxation losses are not taken into account. The spectral composition of the radiation is determined as well as the width of the spectral line in the extreme cases of small and large overpopulation of the levels. (auth)

28929 THE MOST PROBABLE UP-TO-DATE VALUE OF THE NORMAL MOLECULAR VOLUME V_0 OF AN IDEAL GAS. T. Batuecas (Univ. of Santiago, Spain). p.139-48 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

The bases of the method of limiting gas density for the determination of the normal molecular volume are reviewed, together with the progress achieved in the determination of the normal volume. Some research on oxygen is stressed, and the mean of some high-precision measurements is taken to be the most probable value. (D.C.W.)

28930 PRESENT STATUS OF OUR KNOWLEDGE OF THE NUMERICAL VALUES OF THE FUNDAMENTAL PHYSICAL CONSTANTS. E. Richard Cohen (North American Aviation Science Center, Canoga Park, Calif.) and J. W. M. DuMond. p.152-86 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

The status of the fundamental physical constants is summarized, with emphasis on recent measurements by which the values were improved. The analysis of the data is briefly discussed, and a partial list of recommended physical constants is included. 58 references. (D.C.W.)

Accelerators

28931 (AD-608899) CONTROLLED ELECTRON BUNCHER. William C. Quinn and Frank E. Welker (Rome Air Development Center, Griffiss AFB, N. Y.). Oct. 1964. 22p. (RADC-TDR-64-453). $1.00(CFSTI).

A method is described for forming and accelerating isolated high density bunches of electrons. The device is capable of either repetitive or single-shot operation. A theoretical treatment is given and experimental results are discussed. Nine experimental models were fabricated and the principles of operation were demonstrated. (auth)

28932 (BNL-8677) COMPUTER CALCULATIONS OF THE EFFECTIVE LENGTH OF AGS MAGNETS. P. F. Dahl and G. Parzen (Brookhaven National Lab., Upton, N. Y.). Dec. 3, 1964. Contract AT-30-2-GEN-16. 5p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

The SIBYL computer program is used to calculate the effective lengths of Brookhaven AGS magnets, with an accuracy of several percent. The program does not take into account the radial magnetic-field variations in these magnets. The results allow the orbit properties of the accelerator to be computed. (T.F.H.)

28933 (BNL-8914) NETWORK REPRESENTATION OF $\pi/2$ MODE ACCELERATING WAVEGUIDE SYSTEM. J. P. Blewett (Brookhaven National Lab., Upton, N. Y.). Feb. 8, 1965. Contract AT(30-2)-Gen-16. 7p. Dep.(mn); $1.00 (cy), 1(mn) CFSTI.

An iris-loaded waveguide system in which short and long cells alternate with $\pi/2$ phase shift from cell to cell is discussed. A lumped circuit equivalent is proposed, displaying many of the properties of the waveguide system. The mesh equations for the two cell types in the equivalent circuit are given, and the frequency is derived as a function of the phase shift. A numerical example is given, and plots of the frequency and current ratios of the two cells as functions of the phase shift are shown. (M.J.T.)

28934 (BNL-8937) PROPOSED REMOTE HANDLING METHODS FOR A MODIFIED AGS. C. R. Flatau (Brookhaven National Lab., Upton, N. Y.). [1964]. Contract AT(30-2)-Gen-16]. 10p. (CONF-650306-5). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From Particle Accelerator Conference, Washington, D. C.

Proposals to modify the Brookhaven AGS to run at beam intensities of 2×10^{13} protons/sec imply high rates of induced radioactivity. The handling problems associated with the components in the machine enclosure and proposed remote handling methods are discussed. (L.B.S.)

28935 (BNL-8971) VARIABLE MODE SOLID STATE MAGNET CYCLE TIMER. R. Frankel (Brookhaven National Lab., Upton, N. Y.). [Mar. 10, 1965]. Contract [AT(30-2)-Gen-16]. 5p. (CONF-650306-13). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From Particle Accelerator Conference, Washington, D. C.

A variable-mode magnet-cycle timer for the Brookhaven AGS is described. The timer can provide six distinct main-magnet current waveforms, thus making possible the use of the AGS for concurrent experiments having differing analytical requirements. (T.F.H.)

28936 (BNL-8983) A REGULATED, PULSED-CURRENT SYSTEM FOR FOCUSSING MAGNETS. R. A. Larson (Brookhaven National Lab., Upton, N. Y.). [Mar. 3, 1965]. Contract [AT(30-2)-Gen-16]. 9p. (CONF-650306-19). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From Particle Accelerator Conference, Washington, D. C.

Three-inch aperture quadrupole focussing magnets are used at the Brookhaven AGS, in the part of the beam transport system between the preinjector and the linac. The linac is used as the AGS injector. The design and construction of the power supplies for these quadrupole magnets are described. The power supplies produce output currents of 50 to 500 amperes in 50-μsec pulses with regulation of 0.5% during the pulse, and repetition rates of 5 pulses per sec. The principles of operation, component design, and performance of the power supplies are reviewed. (T.F.H.)

28937 (BNL-9057) COMPUTER CALCULATIONS OF MODIFIED AGS MAGNETS. P. F. Dahl (Brookhaven National Lab., Upton, N. Y.). Mar. 18, 1965. Contract AT-30-2-GEN-16. 16p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

The SIBYL computer program is used in an analysis of the effects of modifications of the coil geometry of the AGS C magnets. It is assumed that the modifications do not alter the theoretical gradient index or vertical aperture of the AGS. (T.F.H.)

28938 (CEA-R-2745) CONTRIBUTION A L'ETUDE DU MODE DEFLECTEUR DANS UN GUIDE CIRCULAIRE A IRIS. (Investigation of the Deflecting Mode in Circular Iris-Loaded Waveguides). Harald Hahn (Commissariat à l'Energie Atomique, Saclay (France). Centre d'Études Nucléaires). 1965. 174p. Dep.(mn).

Thesis submitted to Paris Univ., Orsay (France). Faculté des Sciences.

The electromagnetic waves with dipole dependency in circular iris-loaded waveguides were investigated. The general properties of periodic solutions in iris-loaded waveguides, as well as the most general solution of Helmholtz's equation, are presented. It is shown that the transverse electric and magnetic fields are no longer linearly independent if the phase velocity equals the velocity of light. In this case, the electromagnetic field has to be represented by hybrid solutions, which are easily found by using Hertz vectors. The properties of transverse and hybrid solutions are compared. In particular, the deflecting property of hybrid modes was proved. The electromagnetic fields in the center and slots of an iris-loaded guide are represented as Fourier series. The matching of tangential components on the common surface between center and slot leads finally to an infinite system of linear homogeneous equations. The vanishing of its determinant yields the dispersion relation. The infinite matrix is approximated by a finite matrix, which is well adapted to a numerical treatment on a computer. First approximations for all possible modes in an iris-loaded guide are given and compared with experimental results. Then, the construction of a deflecting structure was described. The merit factors of a deflector are defined and the theoretical values for

series impedance Z, R/Q, and quality factor Q are computed and compared with experimental results. Finally, the FORTRAN programs for the IBM 7090/94, allowing the numerical computation of the eigenfrequency, group velocity, space harmonics, field distribution, and of the merit factors Z, R/Q, Q, are presented. (auth)

28939 (CERN-65-1) EFFICIENCY OF MULTI-TRAVERSAL TARGETS. H. G. Hereward, J. Ranft, and W. Richter (European Organization for Nuclear Research, Geneva (Switzerland)). Jan. 6, 1965. 70p. Dep.(mn).

The efficiency of multi-traversal targets in alternating-gradient synchrotrons is analyzed using computer programs. The analysis is based on the particle dynamics in the accelerator, and on the physics of interactions of high-energy beam particles with targets (in the latter case, only proton beams are considered). Results are presented in tabular and graphic form, and are compared where possible with experimental measurements. (T.F.H.)

28940 (CERN-65-2) PARTICLE PRODUCTION FROM 0.6 TO 1.2 Gev/c AT THE CERN PROTON SYNCHROTRON. J. Duboc, A. G. Minten, and S. G. Wojcicki (European Organization for Nuclear Research, Geneva (Switzerland)). Jan. 4, 1965. 21p. Dep.(mn).

A Be target is placed in the beam of the CERN proton synchrotron in order to provide secondary particle beams having momenta of 0.6 to 1.2 Bev/c. The particles comprising the secondary beam include K^+, K^-, p, $\bar{p}$, π^+, and π^-. The beam parameters and particle fluxes are tabulated and shown graphically. (T.F.H.)

28941 (CERN-65-8) SOME RESULTS OF STACKING EXPERIMENTS WITH THE CERN ELECTRON STORAGE AND ACCUMULATION RING (CESAR). S. Hansen, E. Jones, H. Koziol, and M. J. Pentz (European Organization for Nuclear Research, Geneva (Switzerland)). Feb. 25, 1965. 20p. Dep.(mn).

Preliminary experiments on r-f stacking of the electron beam are reported; measurements were accurate to only ±10 to 20%, because of voltage instability of the Van de Graaff injector and insufficiently high vacuum. Experiments were carried out on stacking with full buckets, stacking with partly empty buckets, and displacement of a previously stacked beam with completely empty buckets. The dependence of stacking efficiency on bucket area, phase parameter, and number of beam pulses is discussed. (M.J.T.)

28942 (COO-535-543) A CYCLOTRON POWER-AMPLIFIER RF SYSTEM USING A 4CW50,000C/8350 TETRODE. Jon W. Osterlund and Rodman Smythe (Colorado Univ., Boulder. Dept. of Physics and Astrophysics). [1963]. Contract AT(11-1)-535. 12p. (UCOL-65-39). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

The major change in the power amplifier and other changes in the control circuit of the radiofrequency system of the University of Colorado 52 in. cyclotron are reported. Operating experience with the system is also reported (L.B.S.)

28943 (DESY-65/1) WINKEL- UND STRECKENMESSUNGEN BEIM DEUTSCHEN ELEKTRONEN-SYNCHROTRON DESY. (Angle- and Traverse Measurements at the German Electron Synchrotron DESY). Franz Loeffler (Deutsches Elektronen-Synchrotron, Hamburg (West Germany)). Feb. 1965. 40p. Dep.(mn).

The geodetic measurements for horizontal position, which are necessary for running the German electron synchrotron are reported. The accuracy obtained is shown. (auth)

28944 (EUR-1815.e(Rev.)) ACCELERATOR TARGETS DESIGNED FOR THE PRODUCTION OF NEUTRONS. (Revised English Edition). (Liege Univ. (Belgium)). 248p. (CONF-640206). Dep.(mn).

(Complete Proceedings.)

Accelerator targets designed for the production of mono- or polyenergetic neutrons were studied. Discussions are included, relating mainly to tritium targets, their most efficient use, and improvements to be made in them to increase their life and yield. Twelve papers are included, and separate abstracts were prepared for each. (M.J.T.)

For abstracts of individual papers see: 28627, 28628, 28945, 28946, 28947, 28948, 28949, 28950, 28951, 28952, 28953, and 28954.

28945 (EUR-1815.e(Rev.)(p.182-5)) ACCELERATOR TARGETS FOR NEUTRON GENERATION. Jean Govaerts (Liège. Université).

The use of accelerator beams to generate neutrons via (d,n) and (p,n) reactions on T, D, ^{7}Li, and ^{9}Be is mentioned. Factors determining the lifetime of deuterium and tritium targets are surveyed. Characteristics of targets made by absorbing D or T in a metal layer are summarized. (M.J.T.)

28946 (EUR-1815.e(Rev.)(p.186-8)) BIBLIOGRAPHY FOR TRITIUM AND DEUTERIUM TARGETS. (Liege. Universite).

Twenty-two references on the preparation, performance, and lifetime of tritium and deuterium targets, especially for use as neutron sources, are given. (M.J.T.)

28947 (EUR-1815.e(Rev.)(p.190-200)) TITANIUM-TRITIUM TARGETS. H. Fabian and H. Muenzer (Österreichische Akademie der Wissenschaften. Institut für Radiumforschung und Kernphysik, Vienna).

Results of experimental work on titanium-tritium targets are discussed and compared with various findings discussed previously at the conference. Fabrication and impregnation, testing of T concentration and concentration distribution, behavior under bombardment, design of long-life targets, and design of rotating targets are described. Diagrams are given of T pick-up of oxidized Ti layer as a function of temperature, T loss by diffusion and oxidation, heat resistance of the T-Ti targets, and radioinduced drop in neutron yield and T concentration. (M.J.T.)

28948 (EUR-1815.e(Rev.)(p.201-28)) FABRICATION AND EXAMINATION OF TITANIUM-TRITIUM TARGETS. H. Fabian (Österreichische Akademie der Wissenschaften. Institut für Radiumforschung und Kernphysik, Vienna).

Fabrication of Ti-T targets is discussed, including apparatus for evaporation deposition and impregnation, bottling the T in U containers, Ti-film formation, and impregnation of the Ti layers with T. The general examination of the targets is described, with consideration of uniform layer thickness, flaking of the Ti films, T loss during storage, concentration and distribution of absorbed T, target heat resistance, neutron yield of the targets (with comparison of calculated and experimental results), T loss due to bombardment, target lifetime, and lifetime prolongation using a protective layer. (M.J.T.)

28949 (EUR-1815.e(Rev.)(p.229-34)) ENHANCEMENT OF THE DT NEUTRON OUTPUT OF A 400-KV ACCELERATOR USING A DEUTERIUM ION BEAM OF MIXED COMPOSITION ON THICK Ti-T TARGETS. R. W. Fink (Hamburg. Universität. I. Institut für Experimentalphysik).

A polyenergetic mixed deuterium ion beam, consisting of D_3^+, D_2^+, and D^+ ions and some neutral D, was used to generate neutrons from tritium and deuterium targets. The neutron yield using this beam was found to be considerably enhanced over that using a monoenergetic homogeneous beam. Reasons for the enhanced yield are discussed, and possibilities for still higher yields, using improved target-sample configurations and high-temperature rare earth-tritium targets, are considered. (M.J.T.)

28950 (EUR-1815.e(Rev.)(p.241-5)) A TV-MONITORED TARGET SYSTEM FOR NEUTRON GENERATORS. Matti Nurmia (Helsinki. Univ.).

Modifications made on the SAMES 400-kev accelerator used as a neutron generator are described. The target assembly, with perspex window permitting TV inspection during irradiation, alpha counter tube, and water cooled manual and rabbit target plates, is discussed. Typical T(d,n) yield is mentioned. (M.J.T.)

28951 (EUR-1815.e(Rev.)(p.254-7)) A NEW ROTATING TARGET. Alexander Langsdorf, Jr. (Argonne National Lab., Ill.).

The advantages of a proposed high-speed oil-sealed rotating target, with air cooling inside the rotating tube and with the proton beam striking the outside of the tube, are enumerated. Improved vacuum, better experimental adoptability, and speeds above 2000 rpm would be attained. (M.J.T.)

28952 (EUR-1815.e(Rev.)(p.258-62)) LITHIUM-6 DEUTERIDE TARGETS FOR THE PRODUCTION OF INTENSE FLUXES OF FAST NEUTRONS. Frank S. Williamson (Gt. Brit. Medical Research Council. Radiobiological Research Unit, Harwell, Berks, England).

Thick targets of lithium-6 deuteride were prepared for radiobiological experiments. Intense neutron fluxes with a broad energy spectrum of 0 to 6 Mev with mean energy 3 Mev are produced in the reactions $D(d,n)^3He$, $^6Li(d,n)^7Be$, and $^6Li(d,n)^3He + {}^4He$. The apparatus and processes in target preparation are described, including the vacuum evaporation of Li metal, cooling, and heating to form the deuteride. Stability in the laboratory atmosphere and storage in Ar are discussed. Procedures to ensure beam uniformity on the target are described, and causes of target deterioration are considered. (M.J.T.)

28953 (EUR-1815.e(Rev.)(p.263-70)) REPORT ON COMPARATIVE TESTS WITH TRITIATED AND DEUTERATED TARGETS. G. Breynat, G. Fiat, R. Gerbier, A. Pierson, and H. Vermeersch (France. Commissariat à l'Energie Atomique. Centre d'Études Nucléaires, Grenoble).

Tests to compare the yield and behavior of conventional (Ti-T, -D) and novel (Er- and Y-T and -D) targets for neutron generation with low-energy accelerators are described. Deuteron-accelerator tests were performed on four tritiated targets with various isotopic ratios under various conditions of beam current, voltage, and irradiation time, and neutron flux yields are presented. Tests for measurement of gas release from deuterated targets are described. Temperature effects on the yield of the various targets are discussed. (M.J.T.)

28954 (EUR-1815.e(Rev.)(p.271-82)) DESCRIPTION OF A MERCURY-COOLED URANIUM TARGET USED IN THE CNMB'S LINEAR ELECTRON-ACCELERATOR. C. Allard (Liège. Université).

The target will first consist of natural U and later of ^{235}U; Hg coolant was chosen to avoid excess neutron reflection during future ^{235}U use. Discussions are given of theoretical difficulties in target design, due to the variable beam current, energy, pulse length, and frequency, and of practical difficulties in movable-target construction, cooling-system design, and stainless-steel-cladding preparation. The design of the target, consisting of the active U core and cladding, electromagnetic pump, and heat exchanger is described. (M.J.T.)

28955 (LA-DC-6757) THE DESIGN OF HIGH-INTENSITY MUON CHANNELS FOR A MESON FACILITY. H. S. Butler (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1964]. Contract W-7405-eng-36. 4p. (CONF-650306-34). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From Particle Accelerator Conference, Washington, D. C.

A general computer program is described which calculates the pion acceptance and emittance spectra together with the muon emittance spectrum for a muon channel composed of any arbitrary arrangement of quadrupole magnets and drift spaces. The calculation procedure does not rely on the thin lens approximation nor does it make any assumptions about the length or periodicity of the structure or about the distribution of particles across the acceptance ellipse. This program was used to evaluate the effects on the pion acceptance and muon emittance spectra of varying the spacing, length and field intensity of the quadrupole magnets, of varying the initial drift distance from the target to the start of the channel and of turning off certain magnets of the channel. The results of these calculations are discussed as they relate to the design of muon channels for a high intensity meson facility. (auth)

28956 (LA-DC-6758) THE APPLICATION OF A DIGITAL COMPUTER TO THE CONTROL AND MONITORING OF A PROTON LINEAR ACCELERATOR. T. M. Putnam, R. A. Jameson, and T. M. Schultheis (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [nd]. Contract [W-7405-eng-36]. 4p. (CONF-650306-35). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From Particle Accelerator Conference, Washington, D. C.

Preliminary design studies were carried out on the control system for an 800-Mev proton linear accelerator based on the use of an on-line digital computer as the main controlling element. The accelerator system is divided into fifty-two subsections or modules. A module has complete control of all the equipment associated with it. Selected data and monitoring signals are transmitted on a time-shared basis to a central control computer. The functions which the computer performs in the control of the accelerator may be classified into operational control, operational supervision, and data monitoring and handling. The operator gives instructions to the computer through interrupt lines. Commands to the modules and displays for the operator time share a common channel in the computer output system. Synchronization of the input and output data flow is controlled by the computer through a timing unit. A comparison was made of the computer-based control system with a possible alternate system which does not use a computer. The computer replaces much of the control and data handling equipment required by the alternate system. As a result, the costs of the two systems are comparable. However, the computer-based system is preferable since it has many functional advantages over the alternate system. (auth)

28957 (LA-DC-6797) A 40-KILOVOLT, 125-AMPERE HARD TUBE MODULATOR FOR ACCELERATOR SERVICE. R. W. Freyman (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1965]. Contract W-7405-eng-36. 7p. (CONF-650306-39). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From Particle Accelerator Conference Washington, D. C.

A hard tube modulator designed to generate a 40-Kv pulse at 125 amp for 2 msec at 6% duty factor has been constructed. The rise and fall times will be controlled and the flat top regulated to program requirements. The Machlett ML-LPT 14 was used for the switch tube in this application utilizing magnetic focusing with a coarse grid structure and multiple cathode beams to achieve low grid drive with high plate efficiencies. Low grid drive allows simplification of the drive to one tube driven directly from the rectified r-f control signal. The r-f control signal at 4.8 Mc is coupled across the high voltage interface through a ferrite core transformer. (auth)

28958 (LA-DC-6874) ELECTRICAL BEHAVIOR OF LONG LINAC TANKS AND A NEW TANK-COUPLING SCHEME. B. C. Knapp, E. A. Knapp, G. J. Lucas, D. E. Nagle, and J. M. Potter (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1964]. Contract [W-7405-eng-36]. 9p. (CONF-650306-28). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From Particle Accelerator Conference, Washington, D. C.

The electrical behavior of long linac tanks can be represented by the behavior of a finite chain of coupled harmonic oscillators. A theory is given of chains of oscillators of two kinds, which is appropriate for semi-resonant or resonant coupling structures. The perturbation theory given previously is extended to predict the effects of errors in the coupling cells and in the main cells. Some advantages of $\pi/2$ mode operation of the double chain are discussed. A new accelerating scheme is presented in which the coupling structures are resonant and the tanks are resonantly coupled. The theory, numerical calculations, and measurements on laboratory models all indicate that tolerances on power amplifier voltage

and phase can be relaxed by as much as a factor of five. (auth)

28959 (LNF-64/55) TRANSVERSE BEAM SIZE IN ELECTRON STORAGE RINGS. Note No. 264. C. Bernardini and C. Pellegrini (Laboratori Nazionali di Frascati, Comitato Nazionale per l'Energia Nucleare (Italy)). Nov. 5, 1964. 11p. Dep.(mn).

General formulas are given to obtain the transverse area of an electron beam in a storage ring from the equations of motion in the presence of coupling fields — magnetic fields of the accelerator able to transfer radial into vertical momenta. The structure of the equations of betatron motion, giving rise to both damping and fluctuation forces, is presented, and parameters to be derived from the equations of motion in order to express the spatial distribution are indicated. An example is calculated for a strong focusing machine with localized coupling. (M.J.T.)

28960 (MURA-709) A LOW FIELD SUPERCONDUCTING FFAG MODEL MAGNET. G. del Castillo (Midwestern Universities Research Assn., Stoughton, Wis.). Feb. 26, 1965. Contract W-31-109-eng-38. 36p. Dep.; $2.00(cy), 1(mn) CFSTI.

The possibility of using superconducting surfaces for shaping a magnetic field to have the required H vs r dependence in a magnet of the type used in a radial sector FFAG accelerator is demonstrated for fields below 2 kG. The theoretical results of using superconducting surfaces were confirmed first by using an audio-frequency analog model where the electric skin effect plays the role of the Meissner effect for the superconductor. A study made on different coil-plate geometries indicated that it is possible to obtain exponential fields of the type $H = H_0 \exp K/r_0 \cdot x$. The results obtained with an actual superconductor agree with those of the audio-frequency analog, thus proving that, up to a 2 kG field, it is possible to shape the magnetic field by superconducting surfaces, and modeling studies can be made using an audio-frequency analog. The helium dewar system used in this work makes use of the cold He gas to establish a suitable temperature gradient from room temperature to 4°K to minimize He losses. The probe for measuring the magnetic field at He temperature is a bismuth fiber which presents the characteristics of a single crystal. Fiber voltage sensitivities varied from 5 to 30 volts/gauss-mA, giving an accuracy of about 0.1% when used with a dc amplifier and digital voltmeter system. (auth)

28961 (MURA-711) PRELIMINARY DESIGN DEVELOPMENT OF A VACUUM CHAMBER FOR THE ARGONNE ZGS. G. M. Lee, J. E. O'Meara, and W. R. Winter (Midwestern Universities Research Assn., Stoughton, Wis.). Mar. 1, 1965. Contract W-31-109-38. 10p. Dep.; $1.00 (CFSTI).

The development of one possible design for a new vacuum chamber for the Argonne Zero Gradient Synchrotron is reported with the following features: withstanding full atmospheric load without suffering permanent deformation, operating in a region of high radiation without loss of vacuum or structural integrity, and operating in a pulsing magnetic field with a minimum of eddy current effects. (auth)

28962 (NIRL/R/81) P.L.A. PROGRESS REPORT, 1964. R. C. Hanna and J. M. Dickson, eds. (National Inst. for Research in Nuclear Science, Chilton (England). Rutherford High Energy Lab.). 209p. Dep.(mn)

Increased activities during the period were the result primarily of increased accelerator reliability. The range of possible experiments at the accelerator was extended during the period by commissioning a double-focusing spectrometer and development of equipment for spin-flip in the polarized source. Activities are summarized in chapters on development, accelerator physics, proton scattering and reactions, theoretical studies of nuclear physics, and apparatus and techniques. (J.R.D.)

28963 (NP-14723) STABILIZATSIYA ENERGII IZLUCHENIYA BETATRONA I KALIBROVKA EGO ENERGETICHESKOI SHKALY. (Stabilization of Radiation Energy of a Betatron and Calibration of Its Energy Scale). I. P. Mysev, P. S. Samoilov, and V. S. Uskov (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR)). [1963]. 8p. Dep.(mn).

In controlling the energy of bremsstrahlung radiation, an electronic circuit is selected that directs the accelerated electrons towards the target at the moment when the strength of the magnetic field H is at a definite value. A signal U_{inlet} which is proportional to the magnitude of H is fed to the electronic input, and is compared with a reference voltage U_{ref}, which determines the limiting energy $E_\gamma(max)$ of the bremsstrahlung radiation. The radiation energy is independent of oscillations of various uncontrollable parameters such as variations in voltage supply etc. which change the magnetic field strength. The radiation energy can be stabilized within the limits of ±3 kev for a number of hours, while the energy drift is < ±15 kev over a period of days. The electronic circuit was calibrated by the following threshold reactions: 1) $^{63}Cu(\gamma,n)^{62}Cu$, and 2) $^{16}O(\gamma,n)^{15}O$. The induced ^{62}Cu ($T_{\frac{1}{2}}$ = 10.1 min) and ^{15}O ($T_{\frac{1}{2}}$ = 124 sec) activities were counted with 4π geometry on two end-window counters connected in parallel. The energy $E_\gamma(max)$ was found to be a linear function of the reference voltage which was controlled by a potentiometric resistance. (TTT)

28964 (ORNL-P-1150) ACCELERATING CAVITIES FOR AN 800-Mev SOC. N. F. Ziegler (Oak Ridge National Lab., Tenn.). [1963]. Contract W-7405-eng-26. 8p. (CONF-650306-59). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From Particle Accelerator Conference, Washington, D. C.

The minimum required energy gain per turn for the 800-Mev Separated Orbit Cyclotron increases by a factor of about five from the injection radius to maximum orbit radius. Ordinary rectangular cavities operating in the TM_{110} mode can be used to provide the accelerating voltage; however, the cavity length is then about twice the distance between the inner and outer orbits (~18 ft). This length, and the rf power loss, can be reduced by shaping the cavity to excite in addition the TM_{210} and TM_{310} modes. Inclusion of these higher order modes shifts the maximum voltage from the midpoint of the cavity out toward the end, resulting in a shorter cavity and lower losses. The performance of a ¼-scale model of the shaped rectangular cavity was found to agree quite well with theory. Wedge-shaped cavities were also investigated. In this cavity, which is a sector of a cylinder, the length of the accelerating gap increases with machine radius. The upper and lower boundaries of either type of cavity can be shaped to excite higher order modes. (auth)

28965 (UCRL-11798) EXPERIENCE WITH COMPUTER MODELS OF TWO-DIMENSIONAL MAGNETS. Joseph H. Dorst (Lawrence Radiation Lab., Univ. of California, Berkeley). Mar. 5, 1965. Contract W-7405-eng-24. 9p. (CONF-650306-24). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From Particle Accelerator Conference, Washington, D. C.

Computer programs have been used extensively in the design studies for a 200-Bev synchrotron. Two magnet codes, SIBYL, are currently in use at the Lawrence Radiation Laboratory, Berkeley, for static evaluation of two-dimensional magnets, including finite nonuniform permeability of the iron. Some of the magnet problems for which the computer codes have been used, and the validity or accuracy of the results are discussed. Applications include shaping of the pole for good medium-field profiles and shaping of the pole base to reduce saturation effects. The comparison of calculated and measured fields of the CERN proton synchrotron magnet indicates the attainable quality of computer results. At 14.4 kG, within the limits of the vacuum chamber, the gradient computed by SIBYL was within 1% of the reported gradient. (auth)

28966 PREPARATION OF THIN TARGETS FOR CYCLOTRON IRRADIATION. Ingrid R. Lukas (Inst. of Atomic Physics, Bucharest). Acad. Rep. Populare Romine, Studii Cercetari Fiz., 15: 483-5(1964). (In Rumanian)

The targets prepared for studying nuclear reactions, such

as neutron spectrum determination on the basis of (p,n) and (α,n) reactions, consisted of 0.1-mm thick Ta foils, supporting a 0.1- to 12-μ thick layer of the experimental material. Various methods were used for depositing the material on the support, depending on its properties: In, Ag, and ^{107}Ag foils were prepared by lamination, Fe targets were obtained by electrodeposition. Vacuum evaporation techniques were also examined, although this method often yielded an uneven layer and was wasteful of the starting material and therefore is not recommended for special isotopic or expensive materials. The vacuum deposition tests were carried out at a pressure of 8×10^{-4} to 2×10^{-5} mm of Hg; good targets of In, Mn, Ag, Au, and Cu were thus prepared, including some extremely thin (0.025 to 0.6 μ) layers. C targets were obtained by coating horizontal supports with colloidal graphite. The thickness was determined from weighing which yielded the surface density. (TTT)

28967 STUDY ON THE DEVELOPMENT OF ION SOURCE. Gen Imamura and Hyota Fujita (Mitsubishi Electric Mfg. Co., Ltd., Japan). Mitsubishi Denki Giho, 38: No. 12, 27-35(Dec. 1964). (In Japanese)

Study of the development of ion sources is taken up as essential in research on particle accelerators and high-temperature plasma machines. The history and individual features of each ion source are discussed. Then the principle, construction, and experimental results are reported for the duoplasmatron ion source, the PIG ion source, and the r-f discharge ion source now under study. They are all on the point of practical application as d-c or pulsed ion sources of several hundred μamp ~ scores mamp. Their performances are still under study and development. (auth)

28968 BUILDING PLAN OF A PROTON LINEAR ACCELERATOR. Gen Imamura and Hyoto Fujita (Mitsubishi Electric Mfg. Co., Ltd., Japan). Mitsubishi Denki Giho, 38: No. 12, 74-81(Dec. 1964). (In Japanese)

Mitsubishi Electric Mfg. Co. has completed the basic calculation and design for a proton linear accelerator. It is an Alvarez-type device having a 500-kev Cockcroft-Walton type accelerator with a pulsed ion source as an injector. It aims at an energy of 10 Mev, beam current above 30 mamp (peak value) and repetition below 20 pps. The principle, basic calculation results, design parameters, and problems of study about this accelerator are discussed. (auth)

28969 PULSE OPERATION FOR THE VAN DE GRAAFF ELECTRON ACCELERATOR. Yohta Nakai and Koji Matsuda (Japanese Assn. for Radiation Research on Polymers, Osaka). Nippon Hoshasen Kobunski Kenkyu Kyokai Nempo, 5: 27-32(Nov. 1964). (In Japanese)

For the purpose of observing transient phenomena in radiation chemistry, the Van de Graaff electron accelerator was modified to obtain pulsed electron beams. A pulse generator was inserted at the pentode control grid in the electron beam control circuit located at the high voltage terminal. The output of the pulsed electron beam has repetition frequencies from 100 cps to 20 kcps and the pulse width is variable from $1/2$ to $1/1.5$ of each pulse interval. The rise and decay times of each pulse are less than 1 μsec and 2 μsec respectively. (auth)

28970 ON A METHOD OF POLARIZED PARTICLE INJECTION INTO A CYCLOTRON OR A SYNCHROCYCLOTRON. R. Beurtey and J. Thirion (CEN, Saclay, France). Nucl. Instr. Methods, 33: 338(Mar. 1965). (In French)

A method for the injection of polarized particles is proposed, based on the injection of ionized particles directly into the median plane in the direction of the center by compensating the magnetic force at each point of the trajectory by an equal and opposed electric force. The complete system would consist of an external ionizer using ionization of the atomic jet in a magnetic field having the same axis of symmetry as the jet, acceleration of the ionized jet to 10 kev, and an assembly of trochoidal injection bars. (J.S.R.)

28971 PRINCIPLES OF A NUMERICAL STUDY OF A LINEAR ACCELERATOR. A. Chabert, A. Ferat, and B. Veyron (Institut de Physique Nucleaire, Lyon). Nucl. Instr. Methods, 34: 33-6(Apr. 1965). (In French)

A method of numerical calculation is outlined by which the dynamics of particles in a linear accelerator can be studied. By means of systematic expansions in power series of certain infinitesimals, transfer equations are obtained for given intervals (gaps, drift-tubes). In this formalism, field action is characterized by scalars, the number of which depends on the order of the calculations. (D.C.W.)

28972 A 30-INCH CYCLOTRON FOR ACTIVATION ANALYSIS. A. A. Fleischer (William M. Brobeck and Associates, Berkeley, Calif.). Trans. Am. Nucl. Soc., 8: 84-5(May 1965).

28973 ABSOLUTE ENERGY STANDARDS FOR VAN DE GRAAFF ACCELERATORS. G. C. Phillips (Rice Univ., Houston, Tex.). p.261-78 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

A survey of measurements made at Rice University on neutron-threshold energies for (p,n) reactions, resonance energies for (p,αγ) and (pγ) reactions, and the energy of ^{210}Po alpha particles is presented. The set of absolute calibration energy standards obtained is included. (D.C.W.)

28974 TEORIYA LINEINYKH USKORITELEI. (The Theory of Linear Accelerators). A. D. Vlasov. Moscow, Atomizdat, 1965. 308p.

The theory of linear proton and electron accelerators, and heavy and multicharged particle accelerators is briefly reviewed. Descriptions are given of the effective quadrupole focusing for proton accelerators, magnetic field, screen, and foil focusing. A chapter is devoted to high-current and high-energy particle accelerators and the effects of phase oscillations on the radial motion. Calculation methods are suggested for acceleration and focusing systems. (R.V.J.)

28975 SHORT PULSE-HIGH ENERGY ELECTRON RADIATION TUBE. Walter P. Dyke and Frank J. Grundhauser (to Field Emission Corp.). U. S. Patent 3,173,006. Mar. 9, 1965. Filed Oct. 22, 1962.

An electron radiation tube is described in which electrons are emitted from a cathode structure at least partly by field emission and are caused to pass at high velocity through a thin-walled anode structure and penetrate a substance being treated in a manner that can produce dose rates as high as 2×10^{13} rad/sec with pulse lengths of the order of 0.03 to 0.1 μsec. The anode and cathode structures are both supported within an evacuated envelope, but access to the interior of the anode structure from the exterior of the envelope is provided so that the substance to be treated can be introduced and removed. The device can be so arranged that the material treated can receive electron radiation from a plurality of directions. (A.G.W.)

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Refer also to abstracts 28548, 28634, and 29013.

28976 (D1-82-0366) THE VIRIAL THEOREM FOR SELF-GRAVITATING AND RADIATING GASEOUS SYSTEMS AND ITS APPLICATIONS. Mathematical Note No. 360. S. P. S. Anand (Boeing Scientific Research Labs., Seattle, Wash.). Aug. 1964. 43p. (AD-607352). $2.00 (CFSTI).

The virial tensor equation for self-gravitating gaseous systems in which radiation interacts with matter in the relative motion is obtained. The modified version of this equation in the presence of magnetic field and rotation is also given under the usual assumptions of hydromagnetics. (auth)

28977 (LADC-6429) STELLAR OPACITIES. Arthur N. Cox (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [nd]. Contract [W-7405-eng-36]. 7p. Dep. (mn); $1.00(cy), 1(mn) CFSTI.

The details of radiation transport of energy from the interior of stars are discussed. Opacity calculations are reviewed, taking into account the diffusion of x-ray photons in the stellar interior, photon absorption by electrons in

bound-bound, bound-free, and free-free processes, photon scattering by Thomson and Compton processes, and negative H radical formation. The Rosseland mean opacity is obtained by averaging over photon energy. (M.J.T.)

28978 (ORNL-3758) DYNAMICS OF CYLINDRICAL ELECTROMAGNETIC UNIVERSES. M. A. Melvin (Oak Ridge National Lab., Tenn.). Apr. 1965. Contract W-7405-eng-26. 46p. Dep.; $2.00(cy), 1(mn) CFSTI.

In a previous publication a rigorous solution of the Einstein-Maxwell equations was presented which corresponds to a configuration of parallel magnetic lines of force in equilibrium under their mutual gravitational attraction. This magnetic universe is unstable according to an elementary Newtonian analysis but is stable according to the analysis reported here. In this connection the general time dependent equations for electromagnetic-gravitational fields in the case of cylindrical symmetry are discussed in detail and certain conclusions drawn. Then the solutions as functions of radius and time are found for the two gravitational potential fields and the electromagnetic field which appear when a magnetic universe is subjected to a radial perturbation. It is shown that the magnetic universe is stable (oscillatory) under such perturbations, i.e., all admissible frequencies are real. The converse is also true; all real frequencies are admissible. Every solution is a superposition of proper modes of which there are two types, a "g-type" and "h-type" for each and every real frequency, and for each of the physically interesting fields, i.e., for the electromagnetic field and for the two gravitational fields ("Newtonian potential" and "C-energy," respectively). The g-type modes may be identified roughly as "dominantly gravitational" since in them gravitational perturbations dominate over electromagnetic both at small and large distances; the h-type may be identified as "locally electromagnetic" since in these modes, near the axis, the electric and magnetic perturbations dominate over the gravitational perturbations. The radial dependence of each of the mode types for the various fields is expressed linearly, with radius-dependent coefficients, in terms of Bessel coefficients of order zero and one, respectively. The manner in which an initial perturbation is shaken off is analyzed, and causality is verified. The relevance of the analysis to the understanding of gravitational collapse is discussed. Pure magnetic (or electric) fields are the only presently known systems which resist gravitational collapse. It is suggested that extended magnetic fields may play a role in retarding and finally halting gravitational collapse of material systems. (auth)

28979 ON THE ORIGIN OF A RIGID X-RAY AND RADIOWAVE RADIATION DURING THE SOLAR FLARE OF SEPTEMBER 28, 1961. A. A. Korchak (Inst. of Geomagnetism, Ionosphere, and Radiowave Propagation, Academy of Sciences, USSR). Geomagnetizm i Aeronomiya, 5: 32-9(Jan.-Feb. 1965). (In Russian)

The x-ray burst during the solar flare of Sept. 28, 1961, was the result of the bremsstrahlung of non-relativistic electrons of $E_k \geq 20$ kev and power-law spectrum $\sim E_k^{-3}$. The minimum particle concentration in the emission zone was found to be $\sim 10^{10}$ cm^{-3}. The observed flux was described by $N_e(\geq 20 \text{ kev}) = 3 \times 10^{25}$. An expansion of electron spectrum into the relativistic energy region was used to explain the origin of the burst and for finding the magnetic field strength. (tr-auth)

28980 ON THE THEORY OF SCATTERING OF CHARGED PARTICLES BY THE SIMPLEST COSMIC MAGNETIC FIELDS. L. I. Dorman and Yu. G. Nosov (Polar Geophysical Inst., Kola Branch, Academy of Sciences, USSR). Geomagnetizm i Aeronomiya, 5: 155-9(Jan.-Feb. 1965). (In Russian)

Studies were made of a two-dimensional case in which charged particles are moving in a plane and vector H is perpendicular to the plane. Differential effective cross sections of particle scattering by a homogeneous simple configuration H = constant and diffusion coefficient for charged particles moving across a magnetic field of $H = M/r^n$ were found. (R.V.J.)

28981 INTERPLANETARY GAS. X. CORONAL TEMPERATURES, ENERGY DEPOSITION, AND THE SOLAR WIND. John C. Brandt, Richard W. Michie, and Joseph P. Cassinelli (Kitt Peak National Observatory, Tucson, Ariz.). Icarus, 4: No. 1, 19-36(Apr. 1965).

The hydrodynamic equations are used to derive the temperature of an expanding, spherically symmetric corona from the observed coronal electron densities and the measured electron flux at the orbit of the Earth. Possible complications such as the solar rotation, viscosity, and diffusive separation have been considered and their effect on the calculated temperatures is small within three solar radii. The energy deposition in the corona is derived from the observed densities, the calculated temperatures, an assumed expression for the radiative losses, and the first law of thermodynamics. A significant deposition of energy extends to about two solar radii, and for the homogeneous case, some 10^5 ergs/cm^2 sec is required to maintain the corona. It is found that conduction, both outward and inward, is the major energy loss from the corona; radiative losses appear to be unimportant in the energy balance of the corona. The effects of fine structure in the corona are estimated by considering the corona as a collection of "model-rays" which contain the coronal material. This model gives coronal temperatures of about 2×10^6°K, in essential agreement with the values from ionization data and the observed Doppler widths of coronal lines. The energy deposition required on the inhomogeneous model is two to three times larger than the values required for the homogeneous case, but the extent of significant deposition is approximately the same. For both cases, less energy deposition is required if the thermal conductivity is reduced in the radial direction. The energy equations can be used to predict the electron density at the Earth under the assumption that the conductive and thermal energy supplied by the corona to the interplanetary gas produces sufficient expansion to overcome gravity and yield bulk motion at the orbit of the Earth. If the expansion velocity is taken to be 500 km/sec at the Earth (on the basis of data from comet observations and space probes), the electron densities are found to be in the range 2–6/cm^3. 59 references. (auth)

28982 ABUNDANCE OF HEAVY METALS IN THE HALO RED GIANT STAR HD 122563. Bernard Pagel (Royal Greenwich Observatory, Hailsham, Sussex, Eng.). Nature, 206: 282-3(Apr. 17, 1965).

Theories on the synthesis of elements, especially in halo stars, are discussed. A new analysis of the spectra of heavy metals in the halo red giant star HD 122563 on the basis of the equivalent widths measured by others led to several conclusions: $\Delta\theta_{ex}$ is about 0.30 for neutral lines and about 0.23 for ionic lines; the abundance ratio Fe/H is less than in the Sun by a factor of about 250; the electron pressure is about $1/_{800}$ of its value in the Sun so that H^-, rather than Rayleigh scattering, is still the dominant source of opacity for $\lambda > 4{,}000$; Sr and Y are not significantly under-abundant compared with Fe, while Zr is only marginally under-abundant; Ba, Ce, and perhaps Eu are significantly under-abundant (by a factor ≥ 10) compared with Fe. It was concluded that the Fe had little chance to be recycled in objects resembling BaII or CH stars by the time that HD 122563 was formed. The synthesis of Sr, Y, and Zr, on the other hand, seems to have taken place simultaneously with that of the Fe group itself, or at least very shortly afterwards. (P.C.H.)

28983 SOLAR SPECTROSCOPY IN THE EXTREME ULTRA-VIOLET USING STABILIZED SKYLARK ROCKETS. W. S. Black, D. Booker, B. M. Burton, B. B. Jones, D. B. Shenton, and R. Wilson (United Kingdom Atomic Energy Authority, Abingdon, Berks, Eng.). Nature, 206: 654-8 (May 15, 1965).

A series of experiments is summarized in which the solar u-v and x radiation were investigated by photography and spectroscopy. The instrumentation and its performance are discussed, together with initial results. (D.C.W.)

28984 ANOMALOUS VELOCITIES IN QUASAR 3C273. Christopher Gregory (Univ. of Hawaii, Honolulu). Nature, 206: 702(May 15, 1965).

The possibility that the anomalous velocities (between the light velocity c and ~100c) which are indicated by luminosity fluctuations in 3C273 are due to a hyperdimensional effect was investigated. (D.C.W.)

28985 ENERGETICS OF QUASAR. Daiichiro Sugimoto (Nagoya Univ., Japan). Progr. Theoret. Phys. (Kyoto), 33: 339-41(Feb. 1965).

A theory of the formation of quasars and of energy generations in quasars is outlined. (D.C.W.)

28986 A DETECTOR FOR THE ARGON ABUNDANCE IN THE MARTIAN ATMOSPHERE. F. B. Harrison, W. Bernstein, and J. L. Vogl (Thompson Ramo Wooldridge Inc., Redondo Beach, Calif.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 103(Feb. 1965).

The atmosphere of Mars is assumed to consist of a mixture of argon, nitrogen and carbon dioxide with other gases appearing only in trace amounts. A capsule descending through the Martian atmosphere, containing instruments to measure the pressure, density and temperature, would make possible the determination of the total pressure and mean molecular weight. One more measurement would then be necessary to determine the partial pressures of the three gases. This measurement could be made with an ionization chamber containing an ^{55}Fe x-ray source. In such a chamber the current would be linearly related to the argon content of the atmosphere. (auth)

28987 A METHOD FOR ANALYZING THE SURFACES OF EXTRATERRESTRIAL BODIES. Troy C. Martin, Kenneth R. Blake, and Ira L. Morgan (Texas Nuclear Corp., Austin). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 104-11(Feb. 1965).

A technique for measuring the major elements comprising an extraterrestrial surface is discussed. This technique was used to analyze the elements in a three-element matrix simulating a common meteorite. Some of the advantages and disadvantages are discussed. (auth)

Atomic Physics

Refer also to abstracts 28912, 29109, 29236, and 29265.

28988 (58SD222) INTERACTION OF SLOW ELECTRONS WITH ATOMIC OXYGEN AND ATOMIC NITROGEN. Aerophysics Research Memorandum No. 11. Milton M. Klein and Keith A. Brueckner (Missile and Ordnance Systems Dept., General Electric Co., Philadelphia, Pa.). Apr. 11, 1958. Contract AF04(645)-24. 32p. (AD-606230). $2.00(CFSTI).

The polarization potential for an electron in the field of an oxygen atom was determined by utilizing recent experimental results on the binding energy of 0(-). The corresponding polarization potential for atomic nitrogen was obtained from the results for oxygen by an extrapolation based on the theory of polarization. From these results the photo cross section for 0(-) and the scattering cross section sections for oxygen and nitrogen were calculated. The photo cross section is in good agreement with experimental results. The scattering cross sections are compared with other recent calculations. It is also shown on the basis of the general theory of the photo cross section that the energy dependence of the cross section determines the scattering length for electron scattering. The agreement of the computed photo cross section with experiment therefore is a direct check on the scattering prediction. (auth)

28989 (ARL-65-10) TABLE OF HARTREE-FOCK SELF-CONSISTENT FIELD WAVE FUNCTIONS WITH EXCHANGE. T. K. Krueger, W. L. McDavid, and S. J. Czyzak (Aerospace Research Labs., Wright-Patterson AFB, Ohio). Jan. 1965. 494p. CFSTI.

A table is presented of the Hartree-Fock wave functions for various atoms and ions mainly of astrophysical interest having atomic numbers up to 56. Also included in the table are the one-electron energy parameters and the relativistic and spin-orbit energy corrections. (auth)

28990 (IA-1006) LINEARIZED TABLES OF THOMAS-FERMI-DIRAC SCREENING FUNCTIONS FOR NEUTRAL ATOMS. Adolf A. Abrahamson (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Establishment). Nov. 1964. 110p. Dep.(mn).

In order to render previously available tables of the Thomas-Fermi-Dirac screening functions substantially more amenable for practical use in a large variety of calculations, these tables, for atomic number Z = 2 to Z = 105, have been interpolated for a mesh consisting of 100 numerically simple values of the radial distance from the atomic center. These radial distances are the same for all Z, and spaced linearly within nearly each decade. The complete set of tables for all 104 elements is given. (auth)

28991 (JINR-P-2039) ISSLEDOVANIE STRUKTURY K-MEZORENTGENOVSKOI SERII PRI ATOMNOM ZAKHUATE μ^--MEZONOV V KHIMICHESKIKH SOEDINENIYAKH. (Study of the K-Mesic X-Ray Series Structure in the μ^--Atomic Capture in Chemical Combinations). V. G. Zinov, A. D. Konin, and A. I. Mukhin (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1965. 11p. Dep.(mn).

The structure of the K mesic x-ray series was investigated in μ^- atomic capture in vanadium and vanadium pentoxide as well as in chromium and chromium oxide. A noticeable redistribution of the different K-line yields is observed in the pure substance and its oxide. (auth)

28992 (ORNL-3813) CROSS SECTIONS FOR ATOMIC DISPLACEMENTS IN SOLIDS BY FAST ELECTRONS. O. S. Oen (Oak Ridge National Lab., Tenn.). May 1965. Contract W-7405-eng-26. 54p. Dep.; $3.00(cy), 2(mn) CFSTI.

The Mott series was used to calculate the number of displacements produced by elastic collisions between fast electrons and atomic nuclei. Displacement cross sections of 18 different elements spanning the atomic table were calculated for electron energies ranging from threshold to 10 Mev. Both the primary and the cascade using the Kinchin and Pease model were calculated using sharp displacement thresholds ranging from 15 to 50 ev in steps of either 5 or 10 ev. The results are compared with those using the less accurate McKinley-Feshbach formula commonly used in radiation damage studies. In addition, tables giving the differential cross section in steps of $7\frac{1}{2}°$ for both the Mott series and the McKinley-Feshbach formula are included. (auth)

28993 (UCRL-7826) PRODUCTION OF 44-Å CARBON X RAYS BY 15- to 110-kev PROTONS. J. M. Khan, D. L. Potter, and R. D. Worley (Lawrence Radiation Lab., Univ. of California, Livermore). Apr. 27, 1964. Contract W-7405-eng-48. 19p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Characteristic K-shell x rays (44Å) from carbon were produced by proton bombardment of a thick target. A flow-mode proportional counter (20 cm Hg pressure: 96% He, 4% isobutane) was used to observe the photons. The thick target x-ray yield was measured over the bombarding energy range from 15 to 110 kev. With estimates of the stopping power of the carbon for the protons and the mass absorption coefficient for self absorption, the x-ray production cross section was obtained. With a value for the fluorescence yield of 0.007, the ionization cross section is obtained. This varies from 6×10^{-24} cm^2 to 4×10^{-20} cm^2 at 15 kev and 110 kev, respectively. With direct observation of carbon x rays as a tool, contamination buildup on copper and aluminum was studied as a function of proton current and time. A two-parameter empirical relation was obtained of the form: $n = n_0 + \beta(1 - e^{-\alpha I_p})t$ in units of carbon atoms/cm^2, where $\beta = 0.7 \times 10^{16}$ atoms/cm^2-min, $\alpha = 0.35$ sec/μamp with t in minutes. (System pressure was 1.5×10^{-6} mm Hg, I_p taken at 1.5, 5, and 20 μamp.) The results indicated that carbon was the principal contaminant. (auth)

28994 THE PHOTOEFFECT IN Cu USING Cu Kα_1 X-RADIATION. K. D. Sevier, A. Fahlman, and K. Siegbahn. Arkiv Fysik, 29: 367-73(1965).

The photoelectron emission from the L subshells of Cu in a direction at 90° to that of the x-ray beam was investigated in a semicircular spectrograph set for a resolution of 0.03%. Nuclear research emulsion plates were used for electron detection, and the electron spectrum was analyzed using the electron track counting technique. The Cu $K\alpha_1$ and Cu $K\alpha_2$ radiations were separated by using a monochromator and the $K\alpha_1$ beam was allowed to fall onto the converter. The polarizing effect of the monochromator on the x-ray beam was estimated to be ≈80%. The measured intensity ratios between the converted $L_{II} + L_{III}$ and L_I and the L_{II} and L_{III} subshell electrons were determined. These values are compared with theoretical prediction. (auth)

28995 HETEROGENEOUS RECOMBINATION OF ATOMIC GASES. REACTION OF HYDROGEN ATOMS WITH THE SURFACE OF MOLYBDENUM. V. A. Lavrenko and I. N. Frantsevich. Kosmich. Issled., 3: 135-41(Jan.-Feb. 1965). (In Russian)

The velocities of space vehicles (satellites, spacecraft) are such that the time spent by gas particles near the surface of the vehicle's skin may be comparable with the times required for completion of particle dissociation and recombination processes at its surface. As a result, the local value of the heat flow onto the body is determined to a considerable degree by the rate of the heterogeneous chemical recombination reaction of the corresponding atomic gas on the catalytically active surface of the material. An experimental study of the kinetic interaction of hydrogen atoms with a pure molybdenum surface in the temperature range from 100 to 850°, with the atomic gas at pressures of 0.005-0.05 mm Hg, is reported. The corresponding values of the heterogeneous recombination coefficients $\gamma_{H/Mo}$ were calculated. (tr-auth)

28996 ANGULAR DISTRIBUTION OF HIGH ENERGY SCATTERED X-RAY AND BREMSSTRAHLUNG. Hiroji Noda and Akihiro Siragai (National Inst. of Radiological Sciences, Chiba, Japan). Nippon Igaku Hoshasen Gakkai Zasshi, 24: 1007-10(Nov. 1964). (In Japanese)

When a water phantom was irradiated by electron beams and x rays of 15–29 Mev betatron, the angular distributions of bremsstrahlung and scattered x rays produced in the phantom were measured. The quality of back-scattered bremsstrahlung and x rays were determined by estimation from a lead plate attenuation curve. (auth)

28997 EFFECT OF CORRELATION ON THE ONE-ELECTRON WAVE FUNCTION IN ATOMS. S. Lundqvist (Chalmers Univ. of Tech., Goteborg) and C. W. Ufford. Phys. Rev., 139: A1-3(July 5, 1965).

The effect of correlation on the wave function of a single electron in an atom is discussed in an approximation where the exact nonlocal mass operator for the electron is approximated by a Hartree-Fock-Slater exchange potential plus a local static correlation potential. The correlation potential was taken from recent calculations by Hedin for the electron gas over a large range of densities. The effect of such a correlation potential was calculated in a few cases by numerical integration in first-order perturbation theory, using the functions tabulated by Herman and Skillman as zero-order solutions. The results show a small but distinct contraction of the radial wave functions and give non-negligible corrections to certain single-particle properties such as one-electron energies and the contribution to the diamagnetic susceptibility. (auth)

28998 COHERENCE IN A MODEL OF INTERACTING RADIATION AND MATTER. R. H. Picard and C. R. Willis (Boston Univ.). Phys. Rev., 139: A10-15(July 5, 1965).

Some preliminary results of a theoretical investigation of the origin of laser coherence properties are presented. A model consisting of N two-level atoms in a perfect cavity interacting through their dipole moments with a single mode of the radiation field is adopted, and the resulting many-body problem is made solvable through the introduction of the self-consistent-field approximation (SCFA). It is shown that the SCFA is consistent with Glauber's suggestion that an ideal laser might be in a coherent state, or pure eigenstate of the positive-frequency part of the electric-field operator. A conservation law is derived which assures the positive definiteness of the field-density operator, and it is shown that Glauber's coherent state is that solution of the SCFA equations which minimizes the corresponding constant of the motion. When the SCFA is modified by the introduction of particle-field correlations, the conservation law is destroyed, and the coherent state is no longer an allowed solution. (auth)

28999 COLLISIONAL ELECTRON DETACHMENT FROM HYDROGEN ATOMS AND NEGATIVE HYDROGEN IONS BETWEEN 4 AND 18 Mev. Rodman Smythe and James W. Toevs (Univ. of Colorado, Boulder). Phys. Rev., 139: A15-18(July 5, 1965). (UCOL-64-21; COO-535-525; COO-535-541)

A beam of negative hydrogen ions accelerated by a cyclotron was passed through various gases and the resulting charge states determined by magnetic analysis. Reduction of the data yields values of the cross sections for removing one or both electrons from the negative ion and the cross section for removing the electron from the hydrogen atom. Measurements were made on hydrogen gas at 4.2, 7.4, 9.8, 14.6, and 17.9 Mev; and on helium, nitrogen, oxygen, and argon gases at 14.6 Mev. (auth)

29000 GYROMAGNETIC RATIOS OF HYDROGEN, TRITIUM, FREE ELECTRONS, AND Rb^{85}. L. C. Balling and F. M. Pipkin (Harvard Univ., Cambridge, Mass.). Phys. Rev., 139: A19-26(July 5, 1965).

The spin-exchange optical pumping technique was used to measure the gyromagnetic ratios of hydrogen, tritium, and free electrons in terms of the electronic gyromagnetic ratio of ^{85}Rb. A direct measurement was also made of the ratio of the electronic g factors of tritium and hydrogen. The 60-G magnetic field in which these measurements were made was produced by a precision-wound solenoid which was surrounded by three concentric magnetic shields. The magnetic field varied by 5 parts in 10^6 over the region occupied by a typical absorption flask. The free electrons were produced by ionization resulting from the beta decay of the radioactive tritium atoms. Measurements were made in various sizes of absorption flasks and in flasks containing different pressures of helium, argon, and neon buffer gases. The measured g-factor ratio did not depend upon the nature or pressure of the buffer gas. (auth)

29001 RESONANT CHARGE EXCHANGE IN ATOMIC COLLISIONS. II. FURTHER APPLICATIONS AND EXTENSION TO THE QUASI-RESONANT CASE. William Lichten (Univ. of Chicago and Yale Univ., New Haven). Phys. Rev. 139: A27-34(July 5, 1965).

Applications are made of the previous discussion of charge exchange in wide-angle (small-impact-parameter) collisions between simple atoms. Oscillatory charge exchange is predicted for $H-H^-$ and resonant double exchange for $He-He^{++}$ collisions. The case of near-resonant collisions is treated as a quasi-resonant process with damping, which arises from the lack of exact resonance. As in the resonant case, the frequency of oscillation can be predicted from the molecular model, and a qualitative estimate of damping is possible. A quality factor Q is introduced as a convenient parameter for classifying quasi-resonances in charge-exchange collisions. A discussion is given to account for the presence of oscillatory charge exchange in proton-helium collisions and the lack of oscillations in He^+-H encounters. Pronounced oscillatory behavior is predicted for the $He-Li^{++}$ system, but not for $H-He^+$ or $H-He^{++}$. A discussion is given of ionization by collisions between neutral atoms, such as H-H or H-He. The role of level crossing in resonant charge exchange also is discussed. The failure of the Landau-Zener theory to predict resonant charge exchange is shown to result from omission of quantum-mechanical phase factors. When a properly modified Landau-Zener model is used, oscillatory energy dependence is predicted in certain cases, in agreement with experiment and the present discussion. In general, oscillatory charge exchange is expected in high-Q collisions. (auth)

29002 NONADIABATIC CORRECTIONS TO THE METHOD OF PERTURBED STATIONARY STATES. Lester Ingber (Univ. of California, San Diego, La Jolla). Phys. Rev., 139: A35-9(July 5, 1965).

Using the method of perturbed stationary states, nonadiabatic corrections to the cross section for symmetric resonant charge exchange between a proton and a hydrogen atom in its ground state are induced by considering the role played by the $2P^0$ state. These corrections lead to a polarization of the electron cloud induced by the relative motion of the hydrogen-proton systems. Such effects are found to be important for the calculation of the differential cross section, but are found to play a minor role in determining the value of the total cross section. (auth)

29003 GRYZINSKI ELECTRON-IMPACT IONIZATION CROSS-SECTION COMPUTATIONS FOR THE ALKALI METALS. Robert H. McFarland (Univ. of California, Livermore). Phys. Rev., 139: A40-2(July 5, 1965). (UCRL-12268)

The absolute cross sections for ionization by electron impact were calculated by classical theory for the alkaline metals. The results are in agreement with earlier experimental measurements. (auth)

29004 DOUBLE SCATTERING OF ELECTROMAGNETIC RADIATION BY A FLUID. H. L. Frisch (Bell Telephone Labs., Inc., Murray Hill, N. J. and New York Univ., New York) and J. McKenna. Phys. Rev., 139: A68-77(July 5, 1965).

The standard, first-order theory of the scattering of electromagnetic radiation by a fluid of spherical, electromagnetically isotropic molecules is extended to the study of radiation which is scattered twice before being observed. Expressions for both the average intensity and the average polarization tensor of the doubly scattered light are obtained in terms of the molecular distribution functions of the scattering fluid. It is shown that under appropriate circumstances it may be possible to observe this doubly scattered radiation experimentally, and that data from such an experiment may yield useful information about the three- and four-particle molecular distribution functions of the fluid. (auth)

29005 ELECTRON CORRELATION IN STATISTICAL MODEL CALCULATION OF COMPTON PROFILES. Ashok Jain (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto), 33: 336-7(Feb. 1965).

In x-ray scattering by atoms, electron motion results in a wavelength displacement, the amount of which depends on the electron momentum distribution in the atom. The Compton profile (intensity of the displaced Compton line over all scattering angles and incident wavelengths) was calculated, using a statistical model with inclusion of electron correlation. The inclusion of electron correlation resulted in a marked improvement over values obtained with a Thomas-Fermi-Dirac model of the atom. (D.C.W.)

29006 PRODUCTION OF FAST HYDROGEN ATOMS IN EXCITED STATES BY CHARGE EXCHANGE OF PROTONS AND BY DISSOCIATION OF H_2^+ AND H_3^+ IONS IN He AND Ne. S. V. Bobashev, V. A. Ankudinov, and E. P. Andreev (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksperim. i Teor. Fiz., 48: 833-6(Mar. 1965). (In Russian)

Values of the cross sections are presented for excitation of hydrogen atoms to levels with n = 3 to 7 in the processes of charge exchange of protons and of dissociation of H_2^+ and H_3^+ ions (10 to 30 kev) in He and Ne. The values of the cross sections are derived from the data given previously, using new experimental data on the mean lifetimes of the excited hydrogen atoms. In the case when the fine structure sublevels of the hydrogen atom are populated according to their statistical weights, the cross section decreases as $n^{-2.5}$. (auth)

29007 EXCITATION OF ATOMS BY ELECTRONS AND BROADENING OF SPECTRAL LINES. I. I. Sobelman (Lebedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 48: 965-70(Mar. 1965). (In Russian)

The relation between the theory of spectral line broadening in a plasma and the theory of atomic collisions is discussed. Conditions are formulated which permit one to obtain information on inelastic scattering of slow electrons on excited atoms from data on spectral line broadening. As an example broadening of a number of lines is considered from which the cross sections for inelastic scattering of 3-ev electrons on He atoms or Al^{2+} ions can be estimated. The cross section values thus obtained are in satisfactory agreement with the results of Born approximation calculations. (auth)

29008 DISTRIBUTION OF CHARGES IN ION BEAMS AFTER TRAVERSAL OF GASEOUS TARGETS. L. I. Pivovar, V. M. Tubaev, and M. T. Novikov (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zh. Eksperim. i Teor. Fiz., 48: 1022-32(Apr. 1965). (In Russian)

The charge distributions in non-equilibrium and equilibrium beams of N, Ne, Ar, and Kr ions produced by the passage of gaseous hydrogen, helium, nitrogen, neon, argon and krypton are measured. It is found that the relative amounts of equilibrium fractions in the beam are independent of the ion scattering angle θ and for angles $\theta \neq 0$ the magnitude of the nonequilibrium mean charge decreases with growth of pressure in the collision chamber. A distinct difference in the equilibrium distribution of charges in different gases is established for all investigated ions. Empirical formulas are derived for the dependence of the ratio F_{i+1}/F_i and the mean charge $\bar{l}$ on ion velocity. (auth)

29009 OSCILLATIONS IN A SYSTEM OF TWO-LEVEL MOLECULES AND A RADIATION FIELD. V. F. Chel'tsov. Zh. Eksperim. i Teor. Fiz., 48: 1139-45(Apr. 1965). (In Russian)

The state of a system consisting of one, two, or three two level molecules and a radiation field is investigated in the interaction representation. It is shown that in the case of a self-consistent field, interaction of the molecules via the radiation field is decisive and vanishes in a strong field. The oscillation spectrum for an arbitrary number of molecules consisting of integer harmonics is obtained in the presence of a strong field. (auth)

29010 POPULATION INVERSION OBTAINED BY THERMAL DISSOCIATION OF MOLECULES IN A SHOCK WAVE. A. N. Oraevskii (Lebedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 48: 1150-4(Apr. 1965). (In Russian)

With N_2O taken as an example it is shown that population inversion by thermal dissociation of molecules in a shock wave should be possible. The kinetics of the processes determining the population of the energy levels of the active substance is considered. (auth)

29011 PRECISION MEASUREMENTS ON THE MUON, MUONIUM, POSITRONIUM, AND HELIUM AS RELATED TO FUNDAMENTAL ATOMIC CONSTANTS. J. M. Bailey and V. W. Hughes (Yale Univ., New Haven). p.130-8 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

After a summary of the electromagnetic properties and lifetime of the meson(μ), calculations and measurements of the hfs intervals for hydrogen, muonium, and positronium and of the fine structure intervals of the 2^3P levels of helium are reviewed, together with a determination of the fine structure constant α from the hfs interval of muonium. (D.C.W.)

Cosmic Radiation

See *also* Elementary Particles and Radiations. Nuclear Properties and Reactions.

Refer also to abstract 28420.

29012 (INSJ-84) ANALYSIS OF THE HIGH-ENERGY JETS. PART IV. FOUR-MOMENTUM TRANSFER AND TRANSVERSE MOMENTUM OF RECOIL NUCLEON. Nobuo Yajima and Shunichi Hasegawa (Institute for Nuclear Study, Univ. of Tokyo (Japan)). Dec. 21, 1964. 22p. Dep.(mn).

A method is presented to identify the recoil proton among secondary thin tracks and obtain four-momentum transfer and transverse momentum, using kinematics. Formulas for four-momentum transfer and transverse momentum are introduced. A method for discriminating the recoil proton among secondary thin tracks, taking into account experimental knowledge of the secondary-pion behavior, is discussed. Experimental data published to date are analyzed, and the transverse-momentum distribution is presented for 17 jets identified as the recoil proton. (M.J.T.)

29013 (MIT-2098-123) OBSERVATIONAL WORK ON COSMIC GAMMA RAYS. George W. Clark (Massachusetts Inst. of Tech., Cambridge. Physics Dept. and Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science). Mar. 8, 1965. Contract AT(30-1)-2098. 22p. (CONF-641214-1). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From Texas Symposium on Relativistic Astrophysics, Austin, Tex.

Four experimemts on the observation of cosmic photons from 10^4 to over 10^{15} ev are reviewed. X-ray spectra from 9 to over 62 kev from the Crab nebula were measured using a balloon-carried NaI(Tl) scintillation detector; the temperature required to fit a blackbody spectrum to the data is much higher than the surface temperatures predicted for neutron stars, providing strong evidence against the neutron-star hypothesis for the Crab nebula x-ray source. The second experiment, performed by Overbeck, tested whether the SCO-X1 source is a cloud of energetic electrons producing x rays by inverse Compton scattering of starlight. A search for bremsstrahlung from 3.5 to 28 Mev, which would be produced in electron-ambient gas collisions, yielded negative results; calculations show that the hypothetical electron cloud would be far outside the galaxy. Preliminary results from Explorer-XI experiment for gamma rays above 100 Mev are discussed, and an upper limit on the average integral intensity is given. Gamma spectra above 10^{14} ev were studied by detecting gamma-induced extensive air showers, using a coincidence scintillation-counter array set up on Mt. Chacaltaya near La Paz, Bolivia. Evidence for gamma-induced showers is inconclusive; there is no significant evidence for anisotropy, which would be produced by a concentrated source. (M.J.T.)

29014 (NASA-CR-151) COSMIC-RAY COLLISIONS IN SPACE. PART IV. COSMIC-RAY HAZARDS IN THE SOLAR SYSTEM. Final Report. S. N. Milford (Grumman Aircraft Engineering Corp., Bethpage, N. Y.). Jan. 1965. NASw-699. 44p. $3.00(CFSTI).

Studies are reviewed of: measured cosmic-ray energy and charge spectra near the earth and in the near-earth interplanetary space; effects of planetary magnetic fields and atmospheres on these spectra; cosmic-ray interactions with the lunar surface; the intensity of interplanetary cosmic radiation in the outer solar system (using models); and dose estimations for various regions of space. 60 references. (T.F.H.)

29015 DISTURBANCE OF DAILY VARIATIONS IN COSMIC RAY INTENSITY DURING FORBUSH DECREASE. A. A. Luzov and G. V. Kuklin (Inst. of Geomagnetism, Ionosphere, and Radiowave Propagation, Academy of Sciences, USSR). Geomagnetizm i Aeronomiya, 5: 48-54(Jan.-Feb. 1965). (In Russian)

Sliding harmonics were used in the investigation of the daily cosmic ray variations. Data on the neutron component for various Forbush effects are tabulated according to the geographical location of the recording station. It is shown that daily variations during reduced Forbush effects are determined by the universal time, planetary distribution of the observation points, and by the character of decreased Forbush effect. (tr-auth)

29016 ON THE EXPERIENCE WITH ELECTROSTATIC ANALYZER USED IN THE SATELLITE COSMOS-12. V. V. Mel'nikov, I. A. Savenko, B. I. Savin, and P. I. Shavrin (Moscow State Univ.). Geomagnetizm i Aeronomiya, 5: 148-54(Jan.-Feb. 1965). (In Russian)

Descriptions are given of a spherical electrostatic analyzer used during Cosmos-12 and Cosmos-15 flights for investigations of electron fluxes and positive ions at 1 kev energy. The specifications of the analyzer indicated the band grating width $\Delta E/E \sim 30\%$, and the sensitivity threshold at an isotropic flux $\sim 6 \times 10^6$ particles/cm^2. sec. kev. The data obtained during the flight of Cosmos-12 are tabulated. The constant fluxes of electrons and 1-kev ions at the night side of the earth, ordinarily, did not exceed the analyzer sensitivity threshold. Incidences of increased intensity, mainly of 0.5 to 1 kev electrons, were observed southward from New Zealand. Electrons and ions with E = 1 kev were recorded over the Pacific ocean. (tr-auth)

29017 INCREASE OF COSMIC RAY INTENSITY NOT ASSOCIATED WITH DISTINCT FORMATIONS ON THE SUN. L. I. Dorman, V. G. Koridze, and L. Kh. Shatashvili (Inst. of Geophysics, Academy of Sciences, Georgian SSR). Geomagnetizm i Aeronomiya, 5: 159-61(Jan.-Feb. 1965). (In Russian)

An increase of cosmic radiation intensity not directly related to the visual chromospheric bursts was studied, using neutron data collected by Climax and Sulfur stations. Thirty-six events of sudden burst of intensity were recorded during IGY at Climax station (longitude 106° 11′ W, elev. 3,400 m., geomagnetic threshold $\epsilon \sim 2.9$ Bev) and at the Sulfur station (longitude 115° 36′ W, geomagnetic threshold 0.97 Bev). All 36 events took place during a narrow span of time between 17 and 21 hr U.T. It was confirmed that such sudden bursts of increased intensity appear during the maximum solar activity and can be observed mainly close to noon L.T. (R.V.J.)

29018 DISTRIBUTION OF COSMIC RAY INTENSITY FLUCTUATIONS AT SUCCESSIVE MOMENTS OF TIME. M. V. Alaniya, L. I. Dorman, and L. Kh. Shatashvili (Inst. of Geophysics, Academy of Sciences, Georgian SSR). Geomagnetizm i Aeronomiya, 5: 161-2(Jan.-Feb. 1965). (In Russian)

Studies of experimental data recorded at Climax, Noricura stations during IGY and averaged to the data on strong components recorded at Tokyo and Noricura showed considerable fluctuations caused by certain physical processes. The statistical analysis of fluctuations showed the order of error for Climax station 0.12% and for Noricura 0.21%. The constructed curves showed 0.29 and 0.29% for Climax and Noricura stations. Thus the suggested method enables one to find the real error of the apparatus which is higher than those determined by $\sigma = 1/\sqrt{\bar{n}}$ where $\bar{n}$ is the mean number of pulses observed during 2 hr. The results are in agreement with R. P. Kane (Proc. Indian Acad. Sci., A-52, No. 2, 69 1960) data calculated using the differences in the indices of two stations. (R.V.J.)

29019 DETERMINATION OF COSMIC RAY EQUATOR. Yu. M. Kopylov (Inst. of Geomagnetizm, Ionosphere, and Radiowave Propagation, Academy of Sciences, USSR). Geomagnetizm i Aeronomiya, 5: 166(Jan.-Feb. 1965). (In Russian)

An analysis was made of the cosmic radiation distribution over the Pacific Ocean recorded during the period 12-10-1962 till 1-8-1963 at the geomagnetic longitude $\Lambda = 250$ and 290°. The curves constructed for the neutron component intensity at 250 and 290° longitude in the geomagnetic latitude function ϕ showed $Y = 18.19 - 0.062\,\phi + 0.011\,\phi^2$ and $Y = 16.41 + 0.118\,\phi + 0.009\,\phi^2$, respectively. The equator of cosmic rays at 250° longitude was determined at the point $\phi = -6.5 \pm 0.5°$. The cosmic ray equator coincided with the position of the Earth's real magnetic field according to the dip measured by magnetic devices. (R.V.J.)

29020 ABOUT THE LATITUDINAL DISTRIBUTION OF COSMIC RADIOEMISSION ABSORPTION IN THE IONOSPHERE. Y. S. Korobkov and V. V. Pisareva (Gorkii Univ., USSR). Geomagnetizm i Aeronomiya, 5: 173-7(Jan.-Feb. 1965). (In Russian)

Measurements of cosmic radiation absorption over the Pacific Ocean at 36°N to 18°S latitude (160 to 240° longitude), during May–Aug. 1962, indicated an increased integral absorption with diminishing latitude. However, a certain minimum was observed in the vicinity of the geomagnetic equator. The maximum absorption was observed at the

geographical latitude near 16°N and 11°S. The dependence of the integral radio wave absorption in the ionosphere on the latitude confirmed the presence of geomagnetic effects. (R.V.J.)

29021 ANISOTROPY OF GALACTIC COSMIC RAYS AND THE INTERPLANETARY MAGNETIC FIELD. V. Sarabhai, G. L. Pai, and M. Wada (Massachusetts Inst. of Tech., Cambridge). Nature, 206: 703-4(May 15, 1965). (MIT-2098-97)

An analysis of some data on cosmic-ray anisotropy and the interplanetary magnetic field is summarized. The data indicate that there is usually a virtual sink of galactic cosmic rays towards the sun along the spiralling interplanetary magnetic field and that there is a virtual source along or near the 1800 direction of the orientation histogram. An explanation for the sink is proposed. (D.C.W.)

29022 APPLICATION OF MINIATURE INTRINSIC THERMOCOUPLES FOR REACTOR-TRANSIENT DIAGNOSTICS. Roderick G. Morrison (Los Alamos Scientific Lab., N. Mex.). Trans. Am. Nucl. Soc., 8: 128-9 (May 1965).

29023 SPACECRAFT ACTIVATION BY SOLAR-FLARE PROTONS. D. H. Rusling (North American Aviation, Inc., Downey, Calif.). Trans. Am. Nucl. Soc., 8: 196(May 1965).

Criticality Studies

See also REACTOR TECHNOLOGY — Criticality Studies.

29024 EFFECT OF DISTRIBUTION OF FISSILE MATERIAL ON CRITICAL MASS. H. K. Clark (E. I. du Pont de Nemours and Co., Aiken, S. C.). Trans. Am. Nucl. Soc., 200-1(May 1965).

29025 THE CRITICALITY OF PLUTONIUM-238. Eric H. Ottewitte and Vahe Keshishian (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 8: 201(May 1965).

29026 ONE-VELOCITY MONTE CARLO CALCULATIONS OF URANIUM-METAL CRITICAL GEOMETRIES. J. T. Mihalczo (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 201-3(May 1965).

29027 BILINEAR AVERAGING FOR DIFFUSION THEORY PARAMETERS. Thomas A. Pitterle and Charles W. Maynard (Univ. of Wisconsin, Madison). Trans. Am. Nucl. Soc., 8: 205-6(May 1965).

Direct Energy Conversion

Refer also to abstracts 28496 and 29766.

29028 (AD-607086) THE DEVELOPMENT OF A LOW-TEMPERATURE CYLINDRICAL THERMIONIC GENERATOR. Second Quarterly Technical Report. (Radio Corp. of America, Lancaster, Pa. Direct Energy Conversion Dept.). Sept. 1964. Contract AF33(615)-1547. 54p. $3.00(CFSTI).

A converter Type A-1198B, Serial No. 14, remained on life test for 4470 hours at approximately 150 percent of output power rating with a constant level of 63 watts. The three-converter module A-1274, Serial No. 10 was operated over an emitter temperature range of 1200 to 1350°C for approximately 30 hours with a maximum output of 76 watts. Fabrication of two improved type A-1274 modules was completed. Preliminary tests of these modules indicated the need for modifications of the end-cap diaphragm, ceramic-to-metal seal, and radiator fin configuration. The design and fabrication of the gas injection system was completed and preliminary tests of the system were begun. Two A-1194E converter test vehicles were built to evaluate nickel and molybdenum matrix impregnated with tungsten trioxide as collector materials. Two modified A-1195 variable spacing converters were built, and molybdenum and niobium collectors were tested at high collector temperatures. (auth)

29029 (AD-607528) EFFECT OF ELECTRODE CONFIGURATION ON THERMIONIC CONVERTER OUTPUT CHARACTERISTICS. Third Annual Technical Summary Report, March 1963–March 1964. A. Shavit and S. S. Kitrilakis (Thermo Electron Engineering Corp., Waltham, Mass.). Contract AF19(604)-8453. 153p. (TE-7-65; AFCRL-64-721). $5.00(CFSTI).

The work function of a large planar polycrystalline rhenium emitter in the presence of cesium vapor was determined through measurements of the lower mode saturation current. The range of measurement of emitter temperatures was 700 to 2100 K and of cesium vapor pressures, 0.0002 to 2 mm Hg. The experimental results were extrapolated by another order of magnitude to cesium pressures up to 30 mm Hg to cover the whole range of operations of a thermionic converter. A map showing all the thermionic properties of a rhenium emitter was prepared. In addition, the work function of a polycrystalline molybdenum collector, in the presence of cesium vapor, was determined experimentally through both emission and collection processes. Based on the data obtained, the performance of the thermionic converter was correlated in terms of the deviation of the actual performance from the ideal performance. Particular attention was focused on the current deficiency under ion-rich conditions. A detailed description of the test vehicle is given. (auth)

29030 (AD-608913) THE DEVELOPMENT OF A LOW-WORK-FUNCTION COLLECTOR FOR THERMIONIC ENERGY CONVERTERS. Annual Technical Summary Report No. 2, December 15, 1963–October 15, 1964. W. B. Hall and R. J. Hill (Radio Corp. of America, Lancaster, Pa. Direct Energy Conversion Dept.). Contract NONR-4012(00)-FBM. 78p. $3.00(CFSTI).

The construction and evaluation of a unique device for studying collectors of thermionic converters operating in the Ball-of-Fire mode are described. The test vehicle contains one emitter and a rotating disc on which six collectors are mounted. Without disturbing the vacuum condition, each collector may in turn be brought adjacent to the emitter and the electrode combination can be operated as a converter. The emitter temperature, collector temperature, cesium reservoir temperature, and inter-electrode spacing may all be independently varied and measured. A porous rhenium collector was found to be best in terms of both output voltage and output power. The stability of this kind of collector over a period of time was examined, and design recommendations are made for practical converters on the basis of the findings. (auth)

29031 (AE-173) A PARAMETRIC STUDY OF A LINEAR CONSTANT-MACH-NUMBER MHD GENERATOR WITH NUCLEAR IONIZATION. J. Braun (Aktiebolaget Atomenergi, Stockholm (Sweden). Mar. 1965. 24p. Dep. (mn).

The influence of electrical and gas dynamic parameters on the length of a linear constant-Mach-number MHD duct was investigated. The gas was assumed to be ionized by neutron irradiation in the expansion nozzle preceding the MHD duct. Inside the duct the electron recombination is assumed to be governed by volume recombination. It is found that there exists a distinct domain from which the parameters must be chosen, pressure and Mach number being the most critical ones. If power densities in the order of magnitude 100 Mw/m^3 are desired, high magnetic fields and Mach numbers in the supersonic range are needed. The influence of the variation of critical parameters on the channel length is given as a product of simple functions, each containing one parameter. (auth)

29032 (GA-6102) THERMIONIC CONVERTER NETWORK RELIABILITY. J. W. Holland and D. L. Bosseau (General Atomic, San Diego, Calif.). Mar. 19, 1965. Contract NObs-90487. 117p.

High reliability and high voltage output in thermionic converter networks are mutually compatible characteristics when the converters are connected in a matrix-

type network and when system power redundancy is employed. In such a matrix-type network, series-connected converters are cross-connected in parallel between converters so that an alternate path for electrical current is provided in the event of an open-circuit failure. With redundant power initially supplied to the system, some converters can malfunction, the number depending on the network configuration and converter reliability. Evaluations were made of the reliability advantages of cross-connected matrices, the optimum value for the cross-connector resistance, matrix size and shape effects, and the effects of failure propagation and converter degradation. The results show that a tremendous reliability advantage is gained from the use of cross-connectors. With a 24-converter matrix of 3 parallel columns containing 8 cells in series with optimum cross-connectors, a matrix reliability of 0.994 is obtained with 0.95 reliable converters and at a relative power of 70%. Without cross-connectors, the matrix reliability would be 0.78. Converter characteristics used in the analysis were those of contemporary devices with power densities of 10 watts/cm^2 at an 1800°C emitter temperature. A matrix shape study indicated that matrices with about twice as many cells in series as in parallel are the most reliable and are advantageous for voltage production. Optimum matrix size was shown to depend on converter reliability and system power redundancy. For a converter reliability of 0.95 and a relative power of less than 82%, large matrices are the most reliable. For a 50-cell cross-connected matrix, a reliability of 0.9994 was indicated. Failure propagation, due to overheating of normally operating cells as a result of a decrease in cell current arising from adjacent converter failures, was shown to have a negligible role in matrix configurations of interest. Matrix power losses due to converter power degradation were shown to be proportional to the degradation and the number of degraded cells. (auth)

29033 (NAA-SR-Memo-10784) MINIMUM-WEIGHT, SEPARATE-SOURCE PUMP SYSTEM. T. T. Shimazaki (Atomics International, Canoga Park, Calif.). Dec. 7, 1964. Contract [AT(11-1)-Gen-8]. 29p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

A method for calculating the minimum weight, separate-source pump system is presented. The pump is a d-c conduction type pump. The power source is a direct-radiating, thermoelectric converter. (auth)

29034 EXPERIMENTS ON THE MHD GENERATOR DRIVEN BY A PLASMA JET. Toshio Ito and Tetsuya Morikawa (Mitsubishi Electric Mfg. Co., Ltd., Japan). Mitsubishi Denki Giho, 38: No. 12, 2-7(Dec. 1964). (In Japanese)

Experimental results on the MHD generator driven by a plasma jet are discussed. Electric output as high as 15 kw was obtained from the generator and electrical and optical measurements of the basic properties were made. Electric measurements were made on the open circuit voltage, the short-circuit current, and the power output on each electrode segment to determine the variation of these quantities along the axis of the duct. The temperature was measured spectroscopically at both ends of the duct. Measurement of the flow velocity was conducted directly by means of streak photography. The results of these measurements were compared with theoretical values estimated from one dimensional theory. (auth)

29035 DIRECT-ENERGY CONVERSION USING LOW-ENERGY BETA-RADIATION. Gordon L. Brownell, Francis J. Mahoney, and Robert E. Sanders (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nucl. Soc., 8: 77(May 1965).

29036 IMPROVEMENTS IN OR RELATING TO MAGNETOHYDRODYNAMIC GENERATORS. (to Westinghouse Electric Corp.). British Patent 985,074. Mar. 3, 1965. Priority date July 13, 1962, United States.

In the magnetohydrodynamic generator described a cesium ore is used as seeding material in conjunction with combustion product gases. The ore is introduced into the combustion chamber in finely divided form. It decomposes at the temperature of the chamber and the cesium reacts with the combustion products to form cesium carbonate. After the gas passes through the generator duct, the cesium carbonate is removed by a scrubber apparatus. The cesium carbonate may be reused as seeding material for the generator or it may be sold at a price higher than the price of the ore originally used. (A.G.W.)

29037 IMPROVED MAGNETOHYDRODYNAMIC GENERATOR IN WHICH SHORT CIRCUIT AND [END] EFFECTS ARE REDUCED. (to Avco Corp.). British Patent 985,186. Mar. 3, 1965. Priority date Feb. 2, 1961, United States.

A magnetohydrodynamic generator is designed to reduce short-circuit end effects due to eddy currents upstream of the electrodes. The plasma used consists of combustion products or substantially inert gases seeded with an ionizable substance. The seed is injected into the fluid at a point upstream of the beginning of the electrodes a distance sufficient to ensure substantial mixing of the seed with the plasma but insufficient to permit appreciable eddy currents—preferably a distance of $\frac{1}{4}$ to 1 duct diameter upstream of the electrodes. (A.G.W.)

Elementary Particles and Radiations

Refer also to abstracts 28962 and 29308.

29038 (AD-611375) KINEMATICAL AND DYNAMICAL RESONANCES. A. O. Barut and K. H. Ruei (Syracuse Univ., N. Y. Dept. of Physics). [1961]. 10p. (AFOSR-178). $1.00(CFSTI).

A method is given to characterize and distinguish the kinematic and dynamic resonances in the scattering of elementary particles by studying the resonance energy as a function of the coupling constant. The ambiguity of the solutions of the dispersion relations is resolved, and the relation of the kinematic and dynamic resonances to bound states is discussed. (auth)

29039 (ANL-6989) INSIDE QUANTUM FIELD THEORY AND LECTURES ON NEUTRINO INTERACTIONS. Frank Chilton (Argonne National Lab., Ill.). Dec. 1964. Contract W-31-109-eng-38. 32p. Dep.; $2.00(cy), 1(mn) CFSTI.

A review of the fundamental ideas of quantum field theory is presented, with emphasis on features that are relevant to applications. Second quantization is omitted, and interacting and noninteracting fields are discussed. The rules for calculating T matrix elements are listed and examples are presented for bosons and fermions. Neutrino interactions and hyperon production in an SU_3 model are also discussed. (L.B.S.)

29040 (CALT-68-2) OCTET ENHANCEMENT. Roger F. Dashen, Steven C. Frautschi, Murray Gell-Mann, and Yasuo Hara (California Inst. of Tech., Pasadena). [1964]. Contract [AT(04-3)-41]. 22p. (CONF-550-92) Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From the International Conference on High-Energy Physics, Dubna, USSR, Aug. 1964.

A simple universal current-current theory of weak interactions is discussed, which accounts fairly well for all weak phenomena except the nonleptonic $|\Delta I| = \frac{1}{2}$ rule, which presumably should be generalized to a unitary octet rule, covering not only the familiar $|\Delta Y| = 1$ nonleptonic interactions but also the $|\Delta Y| = 0$ nonleptonic interactions. The octet nonleptonic rule is accounted for either (a) by a theory that adds extra current-current products for strongly interacting particles alone, or (b) by a dynamical mechanism that enhances octets by means of strong interactions. A theory of type (a) is distinguished from theory of type (b) by the amount of $|\Delta I| = 1$ in the $\Delta Y = 0$ nonleptonic interaction; the $|\Delta I| = 1$ component is large in the former case and small in the latter case. Experiments involving light nuclei.

which may be able to resolve the two possibilities, are suggested. (auth)

29041 (CALT-68-28) WEAK AND ELECTROMAGNETIC CURRENTS AND STRONG INTERACTIONS SYMMETRIES IN THE BOOTSTRAP PROGRAM. Roger Dashen (California Inst. of Tech., Pasadena). [1964]. Contract AT(11-1)-68. 23p. (CONF-650106-7) Dep. (mn); $1.00(cy), 1(mn) CFSTI.

From Conference on Symmetry Principles at High Energy, Coral Gables, Fla.

It is suggested that in a bootstrap theory of the strong interactions, the weak and electromagnetic currents of the hadrons should satisfy a nontrivial set of self-consistency requirements that might essentially determine the structure of these currents. In such a theory, the set of all self-consistent currents which are allowed by the strong interactions could be used to form a Lie algebra which ought to be a natural symmetry of the strong interactions. (auth)

29042 (CERN-65-12) ETUDES D'INTERACTIONS DE NEUTRINOS DE GRANDE ENERGIE DANS UNE CHAMBRE A BULLES A LIQUIDE LOURD. (Studies of Interactions of High-Energy Neutrinos in a Heavy-Liquid Bubble Chamber). Michel Paty (European Organization for Nuclear Research, Geneva (Switzerland)). Apr. 5, 1965. 21p. Dep.(mn).

A detailed analysis is presented of the events observed at CERN in the heavy-liquid bubble chamber, exposed to an intense beam of high-energy neutrinos. The equivalent of 1,280,800 useful photographs were analyzed, and in a 220-liter volume of freon CF_3Br (density = 1.5), 447 neutrino interactions were detected. The experimental apparatus and the methods used for the analysis are described. The kinematics of the neutrino interactions, the identification of these interactions, and the various criteria used to exclude the background are discussed. The current theory of the interactions of neutrinos is reviewed with emphasis on the Fermi universal interaction, the conservation of weak vector current, and the calculation of the elastic-interaction cross section. An attempt is made to interpret the observed events with respect to studies on the elastic interaction and determination of the axial form factor of the nucleon, the hypothetical intermediate boson and determination of a lower limit for its mass, the production of pions and strange particles by the neutrino, the existence of two neutrinos and various conservation laws, and the upper limit of the contribution of neutral lepton currents. (tr-auth)

29043 (IC/65/16) PROTON-NEUTRON MAGNETIC MOMENT RATIO IN WIGNER'S THEORY OF SUPERMULTIPLETS. Y. C. Leung and A. O. Barut (International Centre for Theoretical Physics, Trieste (Italy)). Feb. 6, 1965. 6p. Dep.(mn).

Wigner's theory of supermultiplets, denoted by its symmetry group SU(4), is reconsidered in view of recent results from studies of the SU(6) group. It is shown that the correct prediction of the ratio of the proton to neutron magnetic moment can be obtained from the SU(4) theory, where the SU(4) group is a subgroup of SU(6) and contains the spin and isospin groups in the form of a direct product. The nucleons are assigned to the 20-dimensional representation of SU(4), contrary to Wigner's approach, in which they are assigned to the 4-dimensional representation. (M.J.T.)

29044 (IC/65/21) ON SOME APPLICATIONS OF SU_3. (Lecture Notes). J. Werle (International Centre for Theoretical Physics, Trieste (Italy)). Mar. 1965. 42p. Dep. (mn).

Some physical applications of the group SU(3) are presented. The formulas of interest are derived, and the physical assumptions and approximations necessary for their derivations are discussed. Particle states are denoted by the quantum numbers for isospin, third component of isospin, and hypercharge; notations for the irreducible representations of SU(3), the dimension of the representation matrices, and the orthonormal basis vectors spanning the carrier space are explained, and the Wigner-Eckart theorem is derived from the reduction formulas and orthogonality theorem for the vectors. The formalisms for SU(2)-isomorphic subgroups of SU(3), related to the isospin, the U-spin, and the V-spin, are developed, and the U-spin structure of the medium strong interactions is discussed. Mass differences among isomultiplets of the same SU(3)-multiplet are ascribed to the medium strong interactions, while differences between masses of particles in a single isomultiplet are due to electromagnetic interactions. Mass formulas of baryons and baryon resonances are developed, deriving the Gell-Mann-Okubo formula. Meson multiplets are considered. The Coleman-Glashow mass relation, neglecting interference terms between the strong and electromagnetic interactions, is derived. SU(3) symmetry in binary fast interactions is discussed, and interaction amplitudes are developed for various processes; the introduction of symmetry breaking, for the case of failure of the assumption of exact SU(3) invariance of the transition matrix, is considered. (M.J.T.)

29045 (IC/65/32) DYNAMICAL GROUPS AS GROUPS OF MOTIONS OF RIEMANNIAN SPACES. R. Raczka (International Centre for Theoretical Physics, Trieste (Italy)). Mar. 1965. 6p. Dep.(mn).

The consequences of the hypothesis that the geometry of an interaction region of elementary particles is a Riemannian geometry are analyzed. The considerations of the energy spectrum of scalar particles lead in a natural way to the Gell–Mann–Okubo mass formula. (auth)

29046 (IC/65/38) POSITON AND NEGATON PLANE WAVES. I. Saavedra (International Centre for Theoretical Physics, Trieste (Italy)). Apr. 1965. 20p. Dep.(mn).

The plane wave solutions of the Dirac equation in the system in which the electron momentum is $p \neq 0$ are constructed, starting from the solutions in the electron rest system ($p = 0$), under the assumption that the Dirac equation describes two kinds of particles, with positive and negative masses respectively. It is then shown that these two types of solutions are related to each other through the usual definition of charge conjugation, i.e., that one describes negatons whereas the other describes positons. (auth)

29047 (IC/65/39) FOLDY-WOUTHUYSEN AND LORENTZ TRANSFORMATIONS. I. Saavedra (International Centre for Theoretical Physics, Trieste (Italy)). Apr. 1965. 14p. Dep.(mn).

An operator (S) is constructed which makes unitary the Lorentz transformation (L) that connects the rest system of the electron with the system in which the electron has a momentum ρ. The unitary operator SL, which turns out to be just the inverse of the Foldy–Wouthuysen transformation, is used to discuss this transformation and the Cini–Touschek transformation. (auth)

29048 (IC/65/40) PROPER TIME FORMULATION OF THE FREE-ELECTRON THEORY. I. Saavedra (International Centre for Theoretical Physics, Trieste (Italy)). Apr. 1965. 20p. Dep.(mn).

A covariant hamiltonian formulation (for the free-particle case) of Dirac's electron theory is given in terms of the proper time of the particle, and the problem of Zitterbewegung is discussed as an example. (auth)

29049 (IC/65/41) THE FROISSART-GRIBOV CONTINUATION AND REGGEON UNITARITY CONDITIONS. [PART] I. J.C. Polkinghorne (International Centre for Theoretical Physics, Trieste (Italy)). Apr. 1965. 21p. Dep.(mn).

An identity is derived which is useful in the discussion of unitary integrals. It is used to discuss single Regge pole insertions in the Froissart-Gribov continuation, and with the help of perturbation theory models a derivation is given of Reggeon unitarity conditions. The general form suggested by Gribov, Pomeranchuk, and Ter-Martirosyan is confirmed. Finally cancellation mechanisms are discussed, and their relation to the mechanism generating Regge poles is emphasized. (auth)

29050 (IC/65/42) POSSIBLE CP-VIOLATION IN MEDIUM STRONG INTERACTION AND SUPPRESSION OF $\Delta S = 1$ CURRENT. Fayyazuddin and Riazuddin (International Centre for Theoretical Physics, Trieste (Italy)). Apr. 1965. 13p. Dep.(mn).

Equal time commutation relations of weak currents are considered within the framework of broken SU(3) × SU(3) symmetry. It is shown that they are consistent with the point of view that the reduced strength of the $\Delta S = 1$ current relative to the $\Delta S = 0$ current may arise due to the breaking of the symmetry. For this point of view, it is essential that the term in the Hamiltonian which violates SU(3) symmetry also violates CP and belongs to the representation (8,1) and (1,8). (auth)

29051 (IC/65/43) PROPER TIME FORMULATION OF THE ELECTRON THEORY. II. ELECTROMAGNETIC INTERACTIONS AND CONSTANTS OF MOTION. I. Saavedra (International Centre for Theoretical Physics, Trieste (Italy)). Apr. 1965. 18p. Dep.(mn).

The proper time formalism developed previously for the free particle case is extended to include the electromagnetic interaction. The free particle formalism is applied to construct a conserved spin angular momentum operator, whose connection with other spin operators described in the literature is discussed in detail. (auth)

29052 (IC/65/44) ISOBAR DIAGRAMS AND INELASTIC RESONANCE PRODUCTION. G. F. Wolters (International Centre for Theoretical Physics, Trieste (Italy)). May 1965. 35p. Dep.(mn).

Experimental results for the reactions $K^-p \to Y_1^{*+}(1385)\pi^+$ and a few other reactions in the few Bev energy region are discussed. Qualitative arguments are given in favor of an interpretation of certain non-peripheral features in terms of isobar diagrams. Subsequently the reaction $K^-p \to pK^{*-}(888)$ is analyzed in a more rigorous approach based on the assumption that, at large momentum transfers at least, K^* production through an intermediate isobar is dominant. This analysis is based on well-established conservation laws, without making use of dynamical assumptions. As a result it is shown that the data at 1.5 Bev/c incident momentum are consistent with the one isobar hypothesis applied in the backward hemisphere of the overall cm-system for isobar spin $\frac{5}{2}$ and positive parity. The amplitudes for disintegration of the intermediate isobar into the final state are approximately determined, up to some ambiguities in phase. (auth)

29053 (IC/65/47) $\tilde{U}(12)$ PREDICTIONS FOR $N\bar{N}$ ANNIHILATION INTO FOUR MESONS. Y. C. Leung and M. A. Rashid (International Centre for Theoretical Physics, Trieste (Italy)). Apr. 1965. 9p. Dep.(mn).

The problem of $N\bar{N}$ annihilation at rest into four mesons is studied using $\tilde{U}(12)$ symmetry. Predictions for annihilation modes where the final products consist entirely of pseudoscalar mesons, and in particular where the products contain two K mesons (forbidden in the case of three-meson production), are sought. Annihilation amplitudes are considered to consist only of regular couplings, which are $\tilde{U}(12)$ invariant quantities, before an identification of the external lines with physical particles is made. Couplings containing symmetry-breaking kinetic energy parts are assumed to be small. The coupling for annihilation at rest into four mesons is given. Annihilation amplitudes for the three-meson decomposition are given in terms of the spin and isospin of the $N\text{-}\bar{N}$ system, and the prescription necessary to obtain the four-meson amplitudes is specified. Predictions easily accessible to experiments are pointed out, involving $p\bar{p}$ and $n\bar{p}$ annihilations. (M.J.T.)

29054 (IC/65/48) ON A SYMMETRY SCHEME DESCRIBED BY A NON-LIE ALGEBRA. J. Werle (International Centre for Theoretical Physics, Trieste (Italy)). Apr. 1965. 14p. Dep.(mn).

The possibility of using a non-Lie algebra A in symmetry considerations is discussed. The algebra A contains the Lie algebras of the Poincaré group P and of the intrinsic symmetry group S. It is shown on a simple example that by imposing suitable commutation relations between the generators of P and S one can obtain a discrete mass formula without breaking the intrinsic symmetry S used for the classification of particles. A non-Lie algebra of the type considered can describe well all the self-interactions of particles but cannot be required as a rigorous symmetry in the case of two or more interacting particles. (auth)

29055 (IC/65/49) FUNDAMENTAL MULTIPLETS. (NOTES OF A LECTURE). A. Ramakrishnan (International Centre for Theoretical Physics, Trieste (Italy)). May 1965. 12p. Dep.(mn).

The Gell-Mann-Nishijima (G-N) relation in the multiplet structure of elementary particles is discussed. The possibility of a G-N relation connecting Q, Y, and U_z scalar quantum numbers in SU(3) symmetry is considered. SU(2) structure is assumed for the fundamental triplet, and all possible G-N relations are deduced. The relations are found to be the same as those obtained by assuming SU(3) symmetry. Higher representations are considered. (D.L.C.)

29056 (IC/65/52) A SIMPLE SOLUBLE MODEL OF A HIGHER SYMMETRY CHARACTERIZED BY A NON-COMPACT GROUP. Harry J. Lipkin (International Centre for Theoretical Physics, Trieste (Italy)). May 1965. 6p. Dep.(mn).

A soluble model exists which contains many of the essential features of the relativistic higher symmetry theories for elementary particles based on the SU(6) scheme. The model shows where the symmetry predictions are correct and where they break down. The symmetry is found to hold for the bound states of particles moving non-relativistically, and for scattering processes in the Born approximation. (D.L.C.)

29057 (ICTP-64/1) SYMMETRIES OF STRONG INTERACTIONS. Abdus Salam (International Centre for Theoretical Physics, Trieste (Italy)). Oct. 1964. 33p. (CONF-550-91). Dep.(mn).

From the International Conference on High-Energy Physics, Dubna, USSR, Aug. 1964.

Successful tests of unitary symmetry are discussed, including (1) the existence of nearly pure multiplets of 1, 8, and 10 particles of the same spin and parity; (2) mass formulas obtained assuming SU(3) symmetry is broken and symmetry-breaking can be treated as a small perturbation; (3) model-dependent mass relations, mixing relations between impure multiplets, intra-multiplet relations, and electromagnetic mass differences; (4) baryon magnetic moments; (5) decay widths; (6) cross-section relations. Composite particle models based on unitary triplets are examined, considering the quark model and the conservative triplet model introducing a new quantum number; dynamical predictions of these models are considered. Group algebras connected with extensions of SU(3) and super-symmetries like SU(3) ⊗ SU(3) are discussed. Dynamical models are mentioned of two classes—those starting with an 8-fold of baryons and mesons and using methods of S-matrix theory to predict the 10-fold, and those attempting to establish the existence of the starting 8-fold itself by the bootstrap method. (M.J.T.)

29058 (ICTP-64/14) SIMULTANEOUS ANALYTIC CONTINUATION TO THE SECOND SHEET IN TWO CROSSED CHANNELS AND THE DETERMINATION OF COUPLING CONSTANTS. A. O. Barut and T. Sawada (International Centre for Theoretical Physics, Trieste (Italy)). Dec. 30, 1964. 7p. Dep.(mn)

A justification is given of the relation between the coupling constants and a particular second sheet singularity. It is shown that the postulate allowing an exact determination of coupling constants within the context of strong interactions can be reduced to a generalized form of analyticity to the effect that the scattering amplitude is, in all its Riemann sheets, as analytic as possible consistent with unitarity. (M.J.T.)

29059 (INR-597/VI/PH) INTERACTIONS OF 10-Gev/c π^- MESONS IN HYDROGEN WITH THE HIGHEST MUL-

TIPLICITY OF CHARGED PARTICLES. J. Bartke, A. Eskreys, G. Pytkowicz, K. Zalewiski, M. Bardadin, L. Michejda, S. Otwinowski, and R. Sosnowski (Institute of Nuclear Research, Warsaw (Poland)). Jan. 1965. 26p. Dep.

A sample of 132 eight- and ten-prong stars produced by 10 Bev/c negative pions from the CERN proton synchrotron in the 80 cm hydrogen bubble chamber was investigated. The events constitute about 2% of all inelastic events and represent the highest multiplicity observed at this energy of primary pions. It is shown that the momentum transfer to the baryon is often very high. The angular distributions of negative and positive pions do not differ much and both are only slightly anisotropic. The average number of neutral pions is low. Some characteristics of eight-prong interactions are compared with those observed for six-prong stars. A criterion for considering the pion-nucleon collisions as central was suggested and an attempt is made to split the cross-section into central and peripheral parts. (auth)

29060 (INSJ-80) SOME CONSIDERATIONS ON "FUNDAMENTAL" AS OPPOSITE TO "COMPOSITE" ELEMENTARY PARTICLES. B. Vitale (Institute for Nuclear Study, Univ. of Tokyo (Japan)). Sept. 1964. 9p. Dep.(mn).

An outline is given of the philosophies governing various classification schemes for "elementary" or "composite" particles. (T.F.H.)

29061 (JINR-E-1856) WEAK INTERACTIONS (THEORETICAL). S. B. Treiman. Revised by A. Pais and S. B. Treiman (Joint Inst. for Nuclear Research, Dubna USSR)). [1964]. 41p. (CONF-550-90). Dep.(mn).

From the International Conference on High-Energy Physics, Dubna, USSR, Aug. 1964.

The theoretical status of weak interactions is reported. The $(\pi^+ + \pi^-)$-decay of long-lived neutral K-particles, leptonic problems, semileptonic reactions, high-energy neutrino reactions, nonleptonic decays, and general aspects of universality for intermediate bosons and the field theoretical approach to a dynamical description of weak interactions are discussed. 102 references. (L.B.S.)

29062 (JINR-P-2020) O NOVYKH PRAVILAKH SUMM DLYA VESHCHESTVENNOI CHASTI AMPLITUDY RASSEYANIYA VPERED. (On New Sum Rules for the Real Part of the Forward Scattering Amplitude). R. Vit (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1965. 9p. Dep.(mn).

A new sum rule for the real part of the $\pi^{\pm}$-p (symmetrical) forward scattering amplitude is derived. For this amplitude $T(k = 0) \geq 0$ (if $\sigma_{tot}(k = 0) \neq 0$) and $\sigma_{tot}(\infty) > \sigma_{tot}(k = 0)$ was obtained. (auth)

29063 (JINR-P-2048) TYAZHELYE MEZONY I NUKLON-NUKLONNYI POTENTSIAL. (Heavy Mesons and Nucleon-Nucleon Potentials). V. V. Babikov (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1965. 10p. Dep.(mn).

Local velocity-dependent nucleon-nucleon potentials are obtained for the exchange of pseudovector ($J^P = 1^+$), tensor ($J^P = 2^+$) and pseudotensor ($J^P = 2^-$) heavy mesons. The recoil effects are taken into account exactly. The relativistic corrections leading to the velocity dependence of the potentials are calculated in the p^2/m^2 approximation, used by Wong for the exchange of scalar, pseudoscalar and vector mesons. (auth)

29064 (JINR-P-2050) GENEALOGICHESKIE KOEFFITSIENTY DLYA α-CHASTITS. (Fractional Parentage Coefficients for α Particles). I. Rotter (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1965. 12p. Dep.(mn).

The fractional parentage coefficients for the separation of four particles from the 1 p-shell are expressed through the coefficients for two particles. Calculations are given for α-particles. (auth)

29065 (JINR-P-2062) ASIMPTOTICHESKIE SOOTNOSHENIYA DLYA SECHENII ROZHDENIYA PIONA V NEITRONNO-NUKLONNOM VZAIMODEISTUII. (Asymptotic Relations of the Pion Production Cross Sections in Neutrino-Nucleon Interaction). Nguyen Van Hieu and Pham Qui Tu (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1965. 7p. Dep. (mn).

The asymptotic equality of the differential cross sections for the processes $\nu + p \rightarrow l^- + \pi^+ + p$ and $\bar{\nu} + p \rightarrow l^+ + \pi^- + p$ is proved. (auth)

29066 (JINR-P-2127) UPRUGOE π^+-p RASSEYANIE NA UGOL 180° PRI IMPUL'SE 3.15 Gev/c. (Elastic Scattering of 3.15-Gev/c Positive Pions on Protons at 180°). I. A. Savin, A. S. Vovenko, B. N. Gus'kov, M. F. Likhachev, A. L. Lyubimov, Yu. A. Matulenko, V. S. Stavinskii, and Yun-chang Hsu (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1965. 7p. Dep.(mn).

The differential cross section for elastic 3.15 Bev/c π^+-meson scattering on protons at 180° was measured. The value of the cross section was found to be 91 ± 1 μbarn-steradian^{-1}, which gives evidence for an existence of pronounced peak in elastic π^+-p backward scattering. (auth)

29067 (LA-DC-6390) EXPERIMENTAL IMPLICATION OF THE MANDELSTAM REPRESENTATION. George A. Baker, Jr. (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1963]. Contract [W-7405-eng-26]. 6p. Dep. (mn); $1.00(cy), 1(mn) CFSTI.

Relations between the power series coefficients of the scattering amplitude can be compared with those determined from experimental phase shifts to give an experimental verification of the Mandelstam representation. The scattering amplitude is given in terms of the energy and momentum transfer variables s_c, s, and t. An arbitrary one of these variables is taken as a function of another, and the scattering amplitude becomes of a dispersion relation form, with the pole terms included in the Stieltjes integrals. The [N,M] Padé approximants are introduced, and necessary and sufficient conditions are found for the dispersion relation to hold. The results are illustrated by the forward scattering amplitude for a hard sphere in a nonrelativistic potential; results of exact calculations and of calculations using the [2,2] approximant are plotted. (M.J.T.)

29068 (MIT-2098-125) A PHOTOPRODUCTION EXPERIMENT USING A SMALL COMPUTER. R. Alvarez, V. Elings (Massachusetts Inst. of Tech., Cambridge), R. Fessel, et al. (Cambridge Electron Accelerator, Mass.). [Mar. 22, 1965]. Contract AT(30-1)-2098. 10p. (CONF-650510-2). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From Purdue Conference on Instrumentation for High Energy Physics, Lafayette, Ind.

An experiment on which a small computer is used to measure the angular distribution of the reaction $\gamma + p \rightarrow \pi^0 + p$ at gamma energies of 1 to 6 Bev is described. Descriptions and diagrams are also given of the magnetic spectrometer used to measure the proton angle and momentum and the gamma ray hodoscope for detecting the π^0 decay gamma rays. (L.B.S.)

29069 (NP-14659) CURRENT-CURRENT INTERACTION AND NONLEPTONIC DECAYS OF HYPERONS. RELATION BETWEEN INTERMEDIATE MESON AND B-MATTER. Kanji Fujii, Yukio Ito, Kenzo Iwata, and Osamu Terazawa (Hokkaido Univ., Sapporo (Japan). Faculty of Science). [1964]. 25p. Dep.(mn).

Under the assumption of the existence of charged intermediate vector bosons, an examination is presented of the problem of unified description of the universality of weak coupling constants, the charged current-current picture of weak interactions, and $|\Delta I| = 1/2$ enhancement of nonleptonic decays. The incompatibility of the mass and coupling constants required for the vector bosons is studied. In the study of the vector boson properties, recourse is made to the characteristics and existence of B-matter. (T.F.H.)

29070 (NP-14959) FIXED-ANGLE METHOD FOR LOW-ENERGY RESONANCE CALCULATIONS. Hugh Burkhardt (European Organization for Nuclear Research, Geneva (Switzerland), and Graham P. McCauley (Birmingham Univ. (England)). Dept. of Mathematical Physics). [1963]. 18p. Dep.(mn).

A new method for the approximate calculation of low-energy resonance phenomena is proposed. It is based on replacing the partial wave amplitudes by linear combinations of fixed angle amplitudes which can be chosen to approximate them arbitrarily closely in the low energy physical region. The N/D integral equations are algebraic and always soluble. Simple solutions for the p-wave π-π problem are given. (auth)

29071 (NP-15010) STRIP APPROXIMATION WITH REGGE POLES AND BOOTSTRAP EQUATIONS FOR PION-PION SCATTERING. Martin Kretzschmar (Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany)). [1964]. 41p. Dep.(mn).

A modified Regge representation was developed previously, distinguished from other Regge representations by the property that its analytic structure is of just the type required by Mandelstam's double dispersion relation. The use of this representation within the framework of a relativistic S-matrix theory for pion-pion scattering is discussed. An approximation to the exact scattering amplitude, termed the strip approximation, is defined as the sum of all possible contributions to the scattering amplitude from Regge poles in the direct or one of the crossed channels. This strip approximation combines the following features: analyticity properties as described by the Mandelstam representation, exact crossing symmetry, Regge behavior at high energies, and description of bound states and resonances at low energies and of forces due to the exchange of reggeized particles. Partial wave amplitudes are discussed, and the unitarity condition for complex angular momentum is introduced. A set of equations is then obtained that seems sufficient in principle for a self-consistent determination of the Regge trajectories located in the right half-plane, and of the background term of the scattering amplitude. Because of the complexity of the equations a numerical treatment is not yet in sight. (auth)

29072 (NP-15014) CALCULATION OF MESON COUPLING CONSTANTS BY NORMALIZATION. Kazuo Yamazaki (Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany)). [1964]. 22p. Dep.(mn).

The $\pi - N$ and $\eta - N$ coupling constants were calculated within the framework of the nonlinear spinor theory by a normalization procedure. The coupling constant is essentially determined by the norm of the meson wave function $\langle o | \chi^*(x)\ \chi(x) |$ meson$\rangle$ which occurs in the nonlinear interaction term. The wave function of the meson which is obtained by the lowest order Tamm-Dancoff approximation, and its time derivatives for a fixed time in terms of an appropriate superposition of free fermion-antifermion wave-functions including nucleon, ghost, and dipoleghost states, the norm of which are known from the 2-point function is approximated. The agreement of the calculated coupling constants with the experimental values is good. Also the agreement with the results of Dhar and Katayama, who treated the same problem with a rather different method, is satisfactory. (auth)

29073 (NP-15070) JOINT DECAY DISTRIBUTION IN DOUBLE RESONANCE PRODUCTION. H. Pilkuhn and B. E. Y. Svensson (European Organization for Nuclear Research, Geneva (Switzerland)). Jan. 12, 1965. 23p. Dep.(mn).

The joint decay distribution for reactions like $K^+p \to K^*N^*$ and $\bar{p}p \to \bar{N}^*N^*$ is derived in terms of the joint spin space density matrix, using helicity formalism. The predictions of the peripheral model for these distributions are briefly discussed, and a general test of the peripheral model is given for the case of parity violation in one of the decays. (auth)

29074 (UCRL-11884) SPIN AND DECAY PARAMETERS OF THE Ξ^- HYPERON. Janice Button-Shafer and Deane W. Merrill (Lawrence Radiation Lab., Univ. of California, Berkeley). Jan. 11, 1965. Contract W-7405-eng-48. 42p. Dep.; $2.00(cy), 1(mn) CFSTI.

Results are presented on the spin and decay parameters of the Ξ^- hyperon, which were obtained from the analysis of events of the type $K^- + p \to K^+ + \Xi^-$ produced with K^- beams of momentum 1.2 to 2.7 Bev/c incident on the 72-inch bubble chamber. Two methods of treating the data are presented, one involving the projection of coefficients in decay distributions and the other involving maximum-likelihood analysis of these distributions. The projection or moment method yields the better estimate of Ξ^- spin, with a result favoring spin $1/2$ and excluding spin $3/2$ to approximately 2.5 standard deviations. The maximum-likelihood method gives good estimates of decay parameters, with α_Ξ (the usual asymmetry parameter) $= -0.30 \pm 0.08$ and with the ratio $\beta_\Xi/\gamma_\Xi = 0.07 \pm 0.19$. The formalism of Byers and Fenster is utilized. (auth)

29075 (UCRL-11971) EXPERIMENTAL STUDY OF MULTIPARTICLE RESONANCE DECAYS. Gerson Goldhaber (Lawrence Radiation Lab., Univ. of California, Berkeley). Jan. 1965. Contract W-7405-eng-48. 99p. (CONF-650106-4). Dep.(mn); $3.00(cy), 2(mn) CFSTI.

From Conference on Symmetry Principles at High Energy, Coral Gables, Fla.

The status of experimental studies on resonance states which give rise to multiparticle decay and unsolved problems in elementary particle physics is reviewed. (L.B.S.)

29076 ON THE CONNECTION BETWEEN THE VERTEX FUNCTION AND THE BETHE-SALPETER WAVE FUNCTION FOR THE DEUTERON. B. O. Enflo (NORDITA, Copenhagen). Arkiv Fysik, 29: 181-94(1965).

The connection between the deuteron vertex function and the deuteron Bethe-Salpeter wave function is investigated. The investigation leads to linear relations between the invariant amplitudes of the vertex function and the components of the Bethe-Salpeter wave function, regarded as a 16-component spinor. From the investigation, it is clear that three of the four invariant vertex function amplitudes are important for the Schrödinger wave function. The relation between the asymptotic D-S admixture and the invariant amplitudes also follows. (auth)

29077 SOME NUMERICAL RESULTS FROM A DISPERSION THEORY OF THE DEUTERON. B. O. Enflo (NORDITA, Copenhagen). Arkiv Fysik, 29: 245-54(1965).

A dispersion-theoretic equation for the deuteron vertex function was formulated previously. It was used here for a numerical evaluation of the function. Results are tabulated. Corrections to the previous work are included. (M.H.R.)

29078 TEST OF THE CONSTANCY OF THE VELOCITY OF ELECTROMAGNETIC RADIATION IN HIGH VACUUM. Petr Beckmann and Peter Mandics (Univ. of Colorado, Boulder). J. Res. Natl. Bur. Std., 69D: 623-8(Apr. 1965).

It is pointed out that Einstein's postulate of the constant velocity of light is verified only indirectly by elementary-particle experiments leaning more or less heavily on present electromagnetic theory, the latter being verified only for low velocities. Direct experiments can be explained by the ballistic theory of light if transparent media, such as gases, reradiate as a secondary source. A direct experiment with coherent light reflected from a moving mirror was performed in vacuum better than 10^{-6} torr. Its result is consistent with the constant velocity of light. (auth)

29079 K^+d SCATTERING WITH SEPARABLE POTENTIALS. Guru Vachan Dass (Delhi Univ.). Nucl. Phys., 69: 612-24(July 1965).

A fit to the K^+N scattering data in the isotriplet state is obtained with separable potentials. The K^+NN problem is formulated with such potentials operative between particle pairs. The K^+d elastic scattering amplitude and another spin triplet function satisfy coupled integral equations. By an iterative procedure, this amplitude is shown to include in a simple fashion, the different orders of multiple K^+N scattering within the deuteron. The off-the-energy-shell K^+N scattering needed in the K^+d scattering amplitude is also taken into account satisfactorily, at least within the framework of the present model. The contribution of the lowest order scattering to the K^+d scattering length was numerically evaluated. (auth)

29080 ELECTROPRODUCTION OF STRANGE PARTICLES AT HIGH ENERGIES. M. P. Rekalo (Inst. of Physics and Tech., Kharkov). Nucl. Phys., 69: 637-51(July 1965).

The K meson electroproduction amplitude at high energies is obtained on the basis of the Regge pole hypothesis in the region of 180°. Two possible variants of the internal parity of the system (KNY) are considered. The asymptotic amplitudes are represented in the factorized form corresponding to the contribution of two Feynman graphs describing the exchange of a reggeon. The helical amplitudes which are oscillating functions of the energy and angle of production are calculated; the contribution of the longitudinal polarization of a virtual photon proves asymptotically smaller than the transverse polarization contribution. Different observed characteristics of the electroproduction of K mesons are calculated. (auth)

29081 SHMUSHKEVICH METHOD FOR BROKEN SU_3. Lance Heiko (Universitat, Bonn). Nucl. Phys., 69: 652-4 (July 1965).

The Shmushkevich method for SU_3 is generalized to include symmetry-breaking. Application to the baryon resonant decuplet is considered. It is found that matrix elements of the symmetry-breaking operator between two different representations of SU_3 may contribute. (auth)

29082 CALCULATION OF CROSS SECTIONS FOR ELECTRODYNAMIC PROCESSES. V. S. Synakh (Computing Centre, Academy of Sciences, Novosibirsk USSR). Nucl. Phys., 69: 655-60(July 1965).

A method is presented for obtaining analytical expressions of the cross sections for the electromagnetic and weak interactions of elementary particles and radiation corrections to them with the aid of an electronic computer. Results are given for the bremsstrahlung in electron-electron and electron-muon collisions as well as for radiative corrections of the order of e^6 to the electron-muon elastic scattering cross section. (auth)

29083 UNITARY SYMMETRY. Fayyazuddin. Nucleus (Lahore), 1: No. 2, 14-16(Apr.-June 1964).

The bases of the unitary symmetry theory are summarized, together with some predictions of the theory and the experimental verification of the hyperon (Ω^-). (D.C.W.)

29084 POSITRON ANNIHILATION IN AN INTERACTING ELECTRON GAS. J. P. Carbotte and S. Kahana (McGill Univ., Montreal). Phys. Rev., 139: A213-22 (July 5, 1965).

The effects of self-energy, as well as hole-particle interaction processes, on the angular correlation of gamma rays from positrons annihilating in an electron gas are studied. The two regions corresponding to emission of momentum smaller and greater than the Fermi momentum p_F are discussed separately. In the first instance, it is found that self-energy effects, at least in the high-density limit, can be accounted for adequately simply by using the static approximation to the dynamic potential in the first-order ladder graph and ignoring altogether first-order self-energy corrections, provided, of course, a plasmon correction is made. In the second case it is shown that owing to dynamic polarization effects the tails occurring beyond p_F are not at all comparable to those expected on a simple model where the positron force is ignored but correlations within the electron gas are treated properly. Hole-particle interaction graphs are not important since they occur in pairs which cancel each other. (auth)

29085 TENSOR POLARIZATION OF DEUTERONS FROM p-d ELASTIC SCATTERING. P. G. Young, M. Ivanovich, and G. G. Ohlsen (Australian National Univ., Canberra). Phys. Rev. Letters, 14: 831-4(May 17, 1965).

The tensor polarization of deuterons from p-d elastic scattering was determined from the proton angular distributions observed for proton energies of 4.06, 5.06, and 5.94 Mev at a laboratory scattering angle of 30° and for proton energies of 6.10, 7.59, and 8.69 Mev at 45°. (D.C.W.)

29086 PHASE OF THE CP-INVARIANCE VIOLATION IN τ^0 DECAY. S. L. Glashow and S. Weinberg (Univ. of California, Berkeley). Phys. Rev. Letters, 14: 835-6 (May 17, 1965).

It is shown that if the ratio of the K_1^0 and K_2^0 decay amplitudes is actually not much less than one in magnitude, then CPT symmetry and the $\Delta T \leq 3/2$ rule require its phase to be very close to ±90°. (D.C.W.)

29087 MIXING MODEL FOR SCALAR MESONS. Laurie M. Brown (Northwestern Univ., Evanston, Ill.). Phys. Rev. Letters, 14: 836-7(May 17, 1965).

It is shown that if the isoscalar mesons (ϵ) and (σ) of spin and parity O^+ are assumed to be mixtures of hypothetical pure unitary singlet and octet isosinglet members σ_0 and ϵ_0, the $T = 1/2$ member of the octet being $\kappa(725)$, then a $T = 1$ meson (ξ) is predicted, decaying predominantly into $\eta + \pi$. (D.C.W.)

29088 CP NONCONSERVATION IN WEAK INTERACTIONS. V. Gupta (California Inst. of Tech., Pasadena). Phys. Rev. Letters, 14: 838-9(May 17, 1965).

The effects of CP violation in weak interactions are discussed on the basis of the weak interaction $L = L_+ + L_-$, where the commutator $L_- = (G/2^{\frac{1}{2}}) \times [J_\alpha^+, J_\alpha]$ has CP = −1. (D.C.W.)

29089 SU(6) AND MESON-EXCHANGE FORCES. Richard H. Capps (Northwestern Univ., Evanston, Ill.). Phys. Rev. Letters, 14: 842-4(May 17, 1965).

It was recently shown that if the baryon-baryon-meson ($BB\mu$) interactions are SU(6) symmetric in the static limit, the baryon-exchange forces may lead to the bootstrapping of the B multiplet in p-wave $B\mu$ states. The possibility that the exchange of the 35-fold meson multiplet μ and the singlet meson leads to bound states of the types μB, $\mu\mu$, BB, and $B\bar{B}$ is investigated. (D.C.W.)

29090 Γ_0 SELECTION RULES IN SU(12) $\bar{p}p$ ANNIHILATION. H. Harari (Israel Atomic Energy Commission, Yavne), H. J. Lipkin, and S. Meshkov. Phys. Rev. Letters, 14: 845-7(May 17, 1965).

The implications of SU(12) invariance for the various annihilation processes are discussed. The use of simple models of SU(12) symmetry breaking to describe two-meson annihilation is briefly considered. (D.C.W.)

29091 MOMENTUM TRANSFER DEPENDENCE OF THE p-MESON MASS IN THE PRODUCTION PROCESS $\pi + N \rightarrow \rho + N$. Keiji Kikkawa (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 33: 71-4(Jan. 1965).

A possibility is presented in order to explain the momentum transfer dependence of the meson (ρ) mass in the production process $\pi + N \rightarrow \rho + N$. (auth)

29092 CLASSICAL BOSON WAVE EXCITATION IN INELASTIC COLLISIONS AND SHADOW SCATTERINGS AT VERY HIGH ENERGIES. Mikio Namiki (Waseda Univ., Tokyo). Progr. Theoret. Phys. (Kyoto), 33: 92-124(Jan. 1965).

Under the assumption that most elastic scatterings at very high energies are the unitary reflection—such as the shadow scattering—of inelastic collisions resulting in the classical heavy boson wave excitation, some important interrelations between the elastic scattering and multiple particle production at very high energies are investigated. Recent analyses of cosmic-ray jets have suggested that direct products of multiple particle production are mainly heavy bosons rather than pions and that the observed pions come from the decay of heavy bosons. Two extreme cases are considered of the final states of the boson assembly: no correlation and coherent boson wave. The real states would be between the two cases. The boson assembly with no correlations is well described by a classical boson wave state which may be identified with the eigenstate of the boson annihilation operator. The coherent wave state, describing the definite phase wave, is defined by the eigenvector of the phase operator. One of the important results is such that there hold the relations $\delta N \propto \sqrt{\bar{N}}$ in the no-correlation case and $\propto \bar{N}$ in the coherent-wave case between the mean variance $\delta\bar{N}$ and the average $\bar{N}$ of the boson multiplicity, and that the mean variance of the boson momentum δk or

of the invariant momentum transfer $\delta\Delta$ must depend on the primary energy p as δk or $\delta\Delta \propto p^{\beta}$, where $\beta = 1$ in the no-correlation case and $\beta < 1$ in the coherent wave case. The present status of experiments is too poor to discriminate sharply between both cases, although the above results are consistent with experiments. Qualified high-energy data above about 1,000 Bev are highly desired. In the no-correlation case the interrelations between the elastic diffraction scattering and the multiple particle production are formulated in some detail, and it is shown that the results are consistent with the existing experiments. Some brief remarks are given on the large-angle elastic scattering and the anti-shrinkage of the proton-antiproton diffraction peak. Finally, a fundamental assumption on the asymptotic behavior of the elastic scattering amplitude in the modern S-matrix theory is criticized from the viewpoint of the multiple particle production phenomena. (auth)

29093 HARD CORE OF THE NUCLEAR FORCE AND MANY FERMION NONLOCAL STRUCTURE OF BARYONS AND MESONS. Shigeru Machida (Rikkyo Univ., Tokyo) and Mikio Namiki. Progr. Theoret. Phys. (Kyoto), 33: 125-50(Jan. 1965).

It is shown that the hard core of the nuclear force at relatively low energies can be regarded as the repulsive force originating from the many-fermion structure of nucleons and the exclusion principle. There it is of vital importance that the "baryon" should be a composite particle composed of three urbaryons (not including any antiurbaryon) in a tightly bound state and that the degree of freedom for a baryon corresponding to three fermions should not be reducible. Along this line of thought, it would be inevitable to accept the hypothesis that the observed particles have the configurations of the ttt type for baryons and of the tt type for mesons, within the framework of the trilocal and bilocal fields with the nonlocal actions. Critical experiments are proposed to test some important predictions obtained from the model. (auth)

29094 NOTE ON THE VARIATIONAL N/D METHOD. Keiji Kikkawa (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 33: 152-4(Jan. 1965).

It is shown that the stationary value of the functional which characterizes the inverse amplitude k cot δ in Ito's method is a minimum if the correct phase shift δ is less than π. Therefore, the Ito method always gives an upper bound of k cot δ or a lower bound of the phase shift δ. (D.C.W.)

29095 STRUCTURE OF THE TWO-PION-EXCHANGE CONTRIBUTION IN NUCLEON-NUCLEON SCATTERING. Susumu Furuichi and Minoru Yonezawa. (Rikkyo Univ., Tokyo) Progr. Theoret. Phys. (Kyoto), 33: 238-50(Feb. 1965).

The structure of the two-pion-exchange contribution in nucleon-nucleon scattering with spinless nucleons and pions is investigated by the partial-wave dispersion relation. It is shown that the unique separation of the two-pion exchange into the iterated one-pion effect and the "proper" two-pion effect is obtained by a suitably defined partial-wave dispersion relation. It is found that the energy dependence of the proper two-pion-exchange contribution is quite different from that of the iterated one-pion effect and resembles the one-boson-exchange contribution. (auth)

29096 REMARKS ON THE RELATIVISTIC COVARIANCE OF THE THEORY OF VECTOR MESONS. Morio Nakamura (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 33: 279-89(Feb. 1965).

The relativistic covariance of the S-matrix is studied for a charged vector meson with an arbitrary value of magnetic moment interacting with the electromagnetic field. It is explicitly shown that within the framework of the ordinary quantum electrodynamics the covariant result can be obtained for the self-energy of a vector meson, the divergent integral is treated properly. A more general and simpler method is also presented to make the whole process of the calculation of the S-matrix completely covariant. The application of the similar method to other types of interaction is also discussed. (auth)

29097 INTERMEDIATE BOSON THEORY IN THE SUPER-WEAK COUPLING WITH NEUTRINO. Seitaro Nakamura (Tokyo Univ.) and Kunio Itami. Progr. Theoret. Phys. (Kyoto), 33: 290-306(Feb. 1965).

On the assumption that intermediate bosons couple with neutrinos in the "super-weak" coupling and with other particles in the "mesostrong" coupling, a theory of the leptonic weak interaction is formulated. Both the Yukawa bosons (without the baryon number) and the Tanikawa bosons (with the baryon number) are included in this scheme. The consequences of the theory to low- and high-energy weak processes are discussed. (auth)

29098 ON THE MCGLINN THEOREM. Yukio Tomozawa (Inst. for Advanced Study, Princeton, N. J.). Progr. Theoret. Phys. (Kyoto), 33: 319-21(Feb. 1965).

The McGlinn theorem concerning the relation between the Poincaré group and the symmetry group of elementary-particle interactions is proved under weaker conditions. It is shown that the consideration of covariance simplifies the proof. (auth)

29099 POSSIBLE EXTENSION OF THE POMERANCHUK-OKUN RULE TO INELASTIC PROCESSES: $(SU_3)^n$. Hirotaka Sugawara (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 33: 334-5(Feb. 1965).

The Pomeranchuk-Okun rule for elastic scattering is generalized to inelastic processes on the basis of the observation that if the scattering particles are not members of the same multiplet, unitary spin is not exchanged between the two multiplets at high energy. The strong interaction has the $(SU_3)^n$ symmetry at high energy, where n is the number of the SU_3 multiplets. (D.C.W.)

29100 FURTHER RESULTS ON p-p PHASE SHIFTS AT 50 Mev. Norio Hoshizaki and Wataro Watari (Kyoto Univ. and Osaka City Univ.). Progr. Theoret. Phys. (Kyoto), 33: 337-9(Feb. 1965).

A phase shift analysis of p-p scattering at 50 Mev was made, using all the available data for the energy range 47.8-52 Mev. (D.C.W.)

29101 REGGE POLE AT VELOCITY-DEPENDENT POTENTIALS WITH INCLUSION OF A YUKAWA POTENTIAL. M. Weigel (Universitat, Frankfurt am Main). Z. Physik, 185: 199-216(1965). (In German)

The analytical behavior of the scattering amplitude with respect to energy and angular momentum is considered for a group of soluble velocity-dependent potentials plus a Yukawa potential. The Yukawa potential is brought in by means of a modified Born approximation. Convergent and semiconvergent expansions of the Jost functions are given for small and large energies. (auth)

29102 CALCULATION OF THE POLARIZATION OF THE RECOIL PROTON IN πN-SCATTERING NEAR THE INELASTIC THRESHOLD. Elmar Sauter (Universitat, Heidelberg). Z. Physik, 185: 263-8(1965).

The polarization of the recoil proton in πN-scattering was calculated as a function of the scattering angle at the energies 150, 170, and 190 Mev. It is shown that this polarization depends sensitively on the πN-scattering phase-shift P_{11}. Slight changes of the other phase-shifts do not affect the polarization to the same extent. New measurements of the differential cross section and of the polarization in the process $\pi^- + p \rightarrow \pi^- + p$ are suggested. They would allow for a new precise phase-shift analysis, which could possibly determine the sign of the P_{11}-phase at the inelastic threshold. This sign is important in connection with the bound-state picture of the nucleon. (auth)

29103 CERTAIN DEDUCTIONS IN THE UNITARY SYMMETRY SCHEME FOR PROCESSES INCLUDING PARTICIPATION OF ω, φ, AND f^0 MESONS. B. L. Ioffe, I. Yu. Kobzarev, and I. Ya. Pomeranchuk (Inst. of Theoretical and Experimental Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 48: 375-8(Jan. 1965). (In Russian)

In the SU_3 symmetry scheme, the mesons (ω) and (φ) both

arise from a mixture of a unitary singlet state and a unitary octet. The mixing parameter was determined by using the experimentally determined masses of these mesons and the Gell-Mann-Okubo mass formula. Relations are given which relate the mixing parameter to the probability of decay of particle A into particle C + ω or φ. From the ratio of decay probabilities to mesons (ω) and (φ), certain properties of the parent particle A can be derived. An example is given for the decay of a V-meson to either π + ω or π + φ. The properties of the f^0 particle can be deduced by observing the relative amplitudes for processes in which a meson and baryon unite to give another baryon plus a meson (f^0). The relative amplitudes are examined for the case of D + p_- = E + f^0, where D is a π^+, a π^-, a K^-, or a K^0 meson, and the properties of the meson (f^0) are deduced from the relative amplitudes. Finally, the properties of the meson (f^0) are studied by examining the partial widths for many channels of decay of the meson (f^0). This scheme is then extended to the decay of the other members of the unitary octet to which the meson (f^0) may belong if it does not lie along a vacuum trajectory. (TTT)

29104 ELECTROMAGNETIC RADIATION FROM A NEUTRON IN AN EXTERNAL MAGNETIC FIELD. I. M. Ternov, V. G. Bagrov, and A. M. Khapaev (Moscow State Univ.). Zh. Eksperim. i Teor. Fiz., 48: 921-7(Mar. 1965). (In Russian)

The possibility of emission of electromagnetic waves by a neutron moving in a magnetic field is demonstrated. The properties of the radiation are investigated. The problem of orientation of the neutron spin as a result of radiation emission is considered. (auth)

29105 PHOTON EMISSION DURING MUON PAIR PRODUCTION IN ELECTRON-POSITRON COLLISIONS. V. N. Baier and V. A. Khoze (Novosibirsk State Univ., USSR). Zh. Eksperim. i Teor. Fiz., 48: 946-51(Mar. 1965). (In Russian)

A simple method which essentially is based on gauge, charge and Lorentz invariance is employed for calculating the exact integral cross section for emission of photons during muon pair production in electron-positron collisions. (auth)

29106 THE BETHE-SALPETER EQUATION AND ROLE OF "CENTRAL" INTERACTIONS. I. M. Dremin, I. I. Roizen, R. B. White, and D. S. Chernavskii (Lebedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 48: 952-64 (Mar. 1965). (In Russian)

It is shown that the equation for the imaginary part of the amplitude and the equation for the total cross section follow from the Bethe–Salpeter equation. In the total cross section equation, the integral term corresponds to the peripheral cross section and the free term to the central interaction cross section. A particular case of the equation is the multiperipheral model. On the basis of the equation for partial waves in the t channel $f_l(t)$, the complex orbital moment apparatus may be used for ascertaining those singularities in the l plane to which various assumptions regarding the nature of the inelastic processes correspond. A variant consistent with two-particle unitarity in which f_l possesses a fixed pole, a moving pole, and a moving cut is considered within the framework of the Bethe–Saltpeter equation. The variant corresponds to the case of asymptotically constant central and peripheral interaction cross sections. It can also be used to describe the production of "fireballs". (auth)

29107 THE DOUBLE BREMSSTRAHLUNG IN COLLIDING BEAMS EXPERIMENTS. V. S. Synakh (Computing Center, Academy of Sciences, Siberian SSR). Zh. Eksperim. i Teor. Fiz., 48: 1111-13(Apr. 1965). (In Russian)

The analytical expression for the differential cross section of the double bremsstrahlung in ee-collisions in the case of large energies and small angles between momenta of initial and final particles in cms is obtained with the aid of an electronic computer. (auth)

29108 ANNIHILATION OF SLOW POSITRONS IN ALKALI METAL HYDRIDES. [PART] II. A. V. Ivanova and E. P. Prokop'ev (Inst. of Chemical Physics, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 48: 1155-8(Apr. 1965). (In Russian)

Five excited states of positronium hydride are calculated by the self-consistent field method. The calculated mean lifetime for the levels is 1.27×10^{-9} sec and satisfactorily agrees with the experimental value for the long-lived component $\tau_2 = (1.52 \pm 0.8) \times 10^{-9}$ sec. Gamma angular correlation curves corresponding to two-photon annilation from the levels are presented. (auth)

29109 CHEMICAL REACTIONS INVOLVING MUONIUM, IDENTIFICATION OF THE PRODUCTS OF INTERACTION WITH MATTER. V. G. Firsov (Inst. of Theoretical and Experimental Physics USSR). Zh. Eksperim. i Teor. Fiz., 48: 1179-83(Apr. 1965). (In Russian)

The magnetic field dependence of precession of the meson (μ^+) spin on the nature of the chemical compound in which it enters is considered. It is shown that an identification of classes of compounds as well as a finer differentiation with respect to precession frequencies of the system of meson-nuclear spins, is possible. (auth)

29110 PRECISION γ-RAY WAVELENGTH MEASUREMENT BY CRYSTAL DIFFRACTION. J. W. Knowles (Atomic Energy of Canada Ltd., Chalk River, Ont.). p.113-29 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

The precision of gamma wavelength determinations by crystal diffraction is discussed. The theoretical bases of such measurements are outlined, and some specific determinations are reviewed. (D.C.W.)

Field Theory and Quantum Mechanics

Refer also to abstract 29039.

29111 (AD-611161) DIRECT MICROWAVE RADIATION FROM 100 kev ELECTRON BUNCHES IN A CIRCULAR ORBIT. Final Report. R. W. Redlich, J. F. Adams, L. G. Space, and W. Menges (Clarkson Coll. of Tech., Potsdam, N. Y.). Jan. 1965. Contract AF30(602)-3049. 132p. (RADC-TDR-64-458). $4.00(CFSTI).

This task called for a study and investigation of the generation of microwave energy by direct radiation from electron bunches orbiting in a strong magnetic field. Electrons were injected into a magnetic field whose strength was 2000 gauss. Microwave energy was detected at the fundamental bunching frequency of 4000 Mc. This energy was measured to be 0.2 microwatts. There was no detectable harmonic microwave energy. Experimental results were in general agreement with the theory, except that the radiation output was much lower than theoretical predictions. This was thought to be due to inadequate bunching. This program has demonstrated that it is feasible to obtain direct microwave radiation by this method. (auth)

For abstracts of individual sections see: 29112 and 29113.

29112 (AD-611161(App.I)) A STUDY OF NEARLY CIRCULAR TRAJECTORIES IN A STATIC MAGNETIC FIELD (thesis). William R. Menges (Clarkson Coll. of Tech., Potsdam, N. Y.). 49p.

A method is developed for solving the electron ballistic equations pertinent to the development of an experimental millimeter-wave generator. The trajectory is solved by the standard equations of motion developed from Newton's Second Law with the additional stipulation that the trajectory be stable. The usual concept of stability is extended to include the less familiar concept of neutral stability. The condition on the magnetic field necessary for stability is determined and a solution of a possible trajectory for an ideal field is accomplished. A numerical method is used to solve the trajectory in the actual field. This method uses empirical field data in a program written for the IBM 1620 computer. (auth)

29113 (AD-611161(App.II)) DIRECT MICROWAVE RADIATION FROM 100 kev ELECTRON BUNCHES IN A CIRCULAR ORBIT (thesis). Lawrence G. Space (Clarkson Coll. of Tech., Potsdam, N. Y.). 46p.

The form of the electromagnetic radiation fields and resulting time average power from an arbitrary rigid rotating charge distribution is found using retarded potential theory. The particular charge distribution used is a collection of electron bunches produced by velocity modulation. Through application of klystron bunching theory, the Fourier coefficients of the distribution are determined and then used to find the expected radiated power. The radiation fields and radiated power, normalized with respect to the Fourier coefficients of the arbitrary charge configuration, were calculated using an IBM 1620 computer. This was done for various electron velocities ranging from v/c = 0.01 to c/v = 0.99. The Fourier coefficients of the charge distribution were calculated on the 1620 also. The results of these calculations are displayed in graphical form with appropriate conclusions being drawn. A brief discussion concerning the maximum harmonic frequency attainable from this method of generation is undertaken. In addition, the expected power output at different energies and harmonic orders is displayed in tabular form for a sinusoidal velocity modulation bunching scheme. Some of the problems encountered in calculating Bessel functions using the IBM 1620 computer are discussed briefly. (auth)

29114 (UCRL-12343) A FORTRAN PROGRAM FOR THE NUMERICAL SOLUTION OF THE SCHRÖDINGER WAVE EQUATION. George Wilcox (Lawrence Radiation Lab., Univ. of California, Livermore). Feb. 1, 1965. Contract W-7405-eng-48. 11p. Dep.; $1.00(cy), 1(mn) CFSTI.

ONDE is a program designed to numerically solve the Schrödinger wave equation with complete screened Coulomb potential. The code can readily be altered to solve any radially symmetrical potential. With minimal changes in the boundary conditions, the Coulomb potential V(r) = $-Ze^2/r$ was solved with this program. (auth)

29115 (UCRL-12461) DEPENDENCE OF THE SOLUTIONS OF THE SCHRÖDINGER EQUATION ON THE DIELECTRIC CONSTANT IN THE COMPLETE SCREENED COULOMB POTENTIAL. Carl A. Rouse (Lawrence Radiation Lab., Univ. of California, Livermore). Apr. 15, 1965. Contract W-7405-eng-48. 11p. (CONF-650703-2). Dep. (mn); $1.00(cy), 1(mn) CFSTI.

From IUPAC Conference on Properties and Uses of Plasma, Moscow.

The complete screened Coulomb potential (CSCP) is extended to include the effects of neutrals. Two approximations are considered; the neutrals as a continuum with dielectric constant η_0 everywhere with the CSCP given by $V^A(r)$, and the neutrals as a continuum but excluded from a mean volume of radius a with the potential $V^B(r)$. In a low-density plasma, the screening radius is the well-known Debye length, which also depends on η_0. Some numerical solutions of the radial Schrödinger equation for s states are given. It is shown that eigenvalues are more sensitive to the magnitude of η_0 through $V^B(r)$ than through $V^A(r)$. (auth)

29116 A FURTHER NOTE ON AN EXTENSION OF EULER'S THEOREM TO MINKOWSKI SPACE. H. M. Schwartz (Univ. of Arkansas, Fayetteville). Am. J. Phys., 33: 376-8(May 1965).

The extension of Euler's theorem to Minkowski space was treated previously (Am. J. Phys., 31: 864(1963)). An alternative treatment is presented, based on the infinitesimal transformations of the Lorentz group. (D.C.W.)

29117 CURVED SPACE AND GRAVITATION. [PART] I. Robert W. Brehme (Wake Forest Coll., Winston-Salem, N. C.). Am. J. Phys., 33: 383-91(May 1965).

A connection is made between geodesics on a curved, two-dimensional space-time surface and the trajectories of objects falling freely in straight paths in time-independent gravitational fields. The treatment is presented on an elementary level, and the Einstein theory is not closely followed. Both geodesic motion and classical gravitation cause accelerations of objects which are not influenced by the intrinsic properties of the object. The acceleration for geodesic motion is velocity as well as position dependent, whereas for classical gravitation, the acceleration depends only on position. However, by the appropriate choice of scale, it is possible to approximate the classical trajectory with geodesic motion to any degree of accuracy. Geodesics on the sphere and cone are given as examples. (auth)

29118 A SCATTERING MATRIX REPRESENTATION IN THE QUANTUM FIELD THEORY. V. G. Kadyshevskii (Joint Inst. for Nuclear Research, Dubna, USSR). Dokl. Akad. Nauk SSSR, 160: 573-4(Jan. 21, 1965). (In Russian)

S = 1 + iR is taken to be the relativistic scattering matrix, given in the interaction representation, and L(p), the Fourier-form of the Lagrangian in the same representation. A solution for the operator equation for $\hat{R}$ is found, considering the matrix R as a fraction of a one-dimensional invariant parameter and a 4-vector. Conditions on the final expression for S are discussed. (M.J.T.)

29119 REGULARIZATIONS OF THE PLANE RESTRICTED THREE-BODY PROBLEM. R. Broucke (California Inst. of Tech., Pasadena). Icarus, 4: No. 1, 8-18 (Apr. 1965).

It is shown that the two nonessential but removable singularities of the plane circular restricted three-body problem can be removed simultaneously by a coordinate transformation, which is defined by the conformal mapping $Z = \frac{1}{4}[\zeta^n + (1/\zeta^n)]$, where n is any finite and nonzero real number. Another regularization is obtained by the mapping $Z = \frac{1}{2}\cos n\zeta$ which is related to the preceding one by substitution $e^{i\zeta}$ for ζ. The first mapping gives Birkhoff's transformation when n = 1. But when n has the value 2, this transformation is related to a coordinate system which was introduced by Lemaitre in the general three-body problem. This transformation for n = 2 is also essentially equivalent to the regularization introduced by R. F. Arenstorf. The second transformation gives Thiele's well-known regularization when n takes the value +1. (auth)

29120 GREEN'S FUNCTIONS FOR A PARTICLE IN A ONE-DIMENSIONAL RANDOM POTENTIAL. Bertrand I. Halperin (Univ. of California, Berkeley). Phys. Rev., 139: A104-17(July 5, 1965).

A method was found for exactly calculating the spectral density A(k,E) for a particle in a one-dimensional random potential, when the potential at each point is statistically independent of the potential at all other points. Generalizations of this method can also be used to find the phonon Green's functions for a chain of atoms of random mass, or to find various two-particle functions, such as the electric conductivity of a system of noninteracting electrons in a random potential. Two functions of the position x on the line are defined which depend on the particular potential configuration and on the parameters k and E. The spectral density is expressed in terms of the probability distribution of these functions when x is at the right-hand end of the line. The distribution is known at the left-hand end, and the values of the functions, as x moves from left to right, form a Markoff process. One can therefore obtain the spectral density by solving the equation of motion for the probability distribution. Further simplification is possible because it is sufficient to know the first two moments of the joint distribution with respect to one variable, and because in the limit of an infinite line, only the asymptotic form of these moments is necessary. The spectral density requires the solution of a pair of differential or integral equations in one variable, while two-particle functions involve similar equations in two variables. Calculations were carried out for the spectral density of a Schrödinger particle in a white-Gaussian-noise potential and of a particle confined to fixed lattice sites in a random thermal-deformation potential. (auth)

29121 VARIATION PRINCIPLE AND SELF-CONSISTENT MASS EQUATION. Kin-ichi Ishida (Yamagata Univ., Japan). Progr. Theoret. Phys. (Kyoto), 33: 151-2(Jan. 1965).

The importance of the variation principle in the vacuum state is demonstrated. Using the Nambu model, it is shown that the stationary condition on the energy expectation value considered as a function of the unknown parameter mass M leads to the self-consistent mass equation. The least-value condition can then select one of the several solutions of the self-consistent mass equation. (D.C.W.)

29122 ON THE STABILITY OF SPONTANEOUS BREAKDOWN SOLUTIONS. Koichi Nakamura (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 33: 251-5(Feb. 1965).

A criterion to discriminate a meaningful solution from others in the theory of the spontaneous breakdown of symmetry is discussed from the viewpoint of the stability of mass equations against small perturbations. It is applied to some simple models. (auth)

29123 SELF-CONSISTENT MASS EQUATION IN THE THEORY OF SPONTANEOUS BREAKDOWN OF SYMMETRY. Kin-ichi Ishida (Yamagata Univ., Koshirakawa, Japan). Progr. Theoret. Phys. (Kyoto), 33: 256-63(Feb. 1965).

In the simple models (Nambu model and Bose fields with the interaction Hamiltonian: $\lambda\varphi^4$ and $\lambda\varphi^3$), it is shown up to the lowest order of the coupling constant that the self-consistent mass equation is equivalent to the requirement that the energy expectation value of the trial vacuum state, in which the particle mass m is involved as the unknown parameter, takes the stationary value as the function of m, and that the minimum condition on the expectation value is written as $df(m)/dm < 1$ for m satisfying the self-consistent mass equation $m = f(m)$. (auth)

29124 TIME REVERSAL NON-INVARIANCE AND WEAK LEPTONIC CURRENT. Kichiro Hiida (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 33: 264-78(Feb. 1965).

For the case in which the theory is not invariant under charge conjugation, space reflection, and/or time reversal, a useful renormalization method is presented. Using the renormalization method, it is proved that even if neutrinos have observed masses, weak leptonic currents can not violate time-reversal invariance in the lowest order of weak interaction and in all orders of strong and electromagnetic interactions, provided that the neutrinos have a vanishing mechanical mass. Further, the masses and magnetic moments of neutrinos and the electric dipole moments of nucleons and leptons are discussed. (auth)

29125 ON THE GRAVITO-C-FIELD IN AN EMPTY REGION WITH SPHERICAL SYMMETRY. Hidekazu Nariai and Kenji Tomita (Hiroshima Univ.). Progr. Theoret. Phys. (Kyoto), 33: 322-33(Feb. 1965).

In view of a possible relevance of the concept of the C-field introduced by Hoyle and Narlikar to the problem of quasi-stellar objects or collapsing stars, an attempt is made to study permissible solutions of their field equations in an empty region with spherical symmetry. Two special (static and pseudo-static) solutions are obtained, and their characteristic properties are examined in the light of Hoyle-Narlikar's exterior but non-empty solution. As a result, it is revealed that the problem of boundary conditions has a crucial importance in the decision of superiority of any one of the three exterior solutions. (auth)

29126 NONLINEAR PERTURBATION THEORY. Jeffery Lewins (Univ. of Washington, Seattle). Trans. Am. Nucl. Soc., 8: 228(May 1965).

29127 ON COHERENT DIVISION OF QUANTA. L. I. Gudzenko and G. M. Guro (Lebedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 48: 1132-8(Apr. 1965). (In Russian)

Features of amplification in a quantum-mechanical system are considered for the case when the energy spectrum of the system has a band restricted from above and containing a large number of practically equidistant levels. Conditions of stationary amplification are considered in the limiting cases of small and large intensities of the amplified radiation. (auth)

Geophysics

Refer also to abstract 29409.

29128 (AD-608484) RESEARCH ON PHYSICS OF THE UPPER ATMOSPHERE. Technical (Final) Report. D. R. Bates, A. Dalgarno, B. L. Moiseiwitsch, A. L. Stewart, A. H. Jarrett, U. Oepik, and M. Rudge (Queen's Univ., Belfast (Northern Ireland)). June 30, 1964. 65p. (AFCRL-64-876). $3.00(CFSTI).

Investigations directly concerned with the upper atmosphere include: theoretical studies of diurnal variation of the temperature of the thermosphere and observational studies of the following: temperature of OI atoms responsible for the 6300 A emission of the nightglow, the 6300 A OI dayglow emission, variations of hydroxyl and oxygen emissions in the infrared airglow, infrared investigations of the night sky using a Michelson interferometer, and all-sky interferometer for air glow studies. Fundamental quantal calculations of collision processes and atomic structure problems are also examined. Collision processes include: calculations of scattering cross sections using the first and second Born approximations, impact ionization cross sections, and photoionization cross sections of molecular hydrogen. Atomic structure problems include: semi-empirical effective potentials for use in atomic, molecular and solid-state problems; three-electron systems, and long range forces between pairs of atoms. (auth)

29129 (AD-608759) EFFECT OF TEMPERATURE CHANGES ON THE ELECTRON DENSITY DISTRIBUTION IN THE F-REGION. Scientific Report No. 226. Y. V. Somayajulu (Pennsylvania State Univ., University Park. Ionosphere Research Lab.). Dec. 1, 1964. Contract AF19(628)-4014. 27p. (AFCRL-64-853). $2.00(CFSTI).

The initial profile is assumed to correspond to photo-equilibrium conditions, with the peak electron density determined by production, loss, and diffusion. The temperature dependence of the production, loss and diffusion parameters are then introduced and the modified profiles are obtained for different temperature changes. The results show that following a temperature increase (by a factor lambda > 1) the electron density at all levels decreases. The height of the peak is located using the theoretical expression. The changed peak electron density obtained from the profile agrees well with that computed from the theoretical expression. Thus, it is concluded that the changed electron density distribution up to the peak can be obtained using this procedure. It is, however, pointed out that while a large production takes place in the electron density at fixed levels, the N (max) decreases only as approximately 1/lambda ($\frac{5}{6}$th or $\frac{1}{2}$ powers). For small changes in temperature (lambda = 1.1) there is a possibility of the slight increase in N (max). Similarity between these results and the behavior of F-region in the equatorial regions is indicated. (auth)

29130 (AFCRL-64-726) PARTICLE TRAJECTORIES IN A MODEL CURRENT SHEET, BASED ON THE OPEN MODEL OF THE MAGNETOSPHERE, WITH APPLICATIONS TO AURORAL PARTICLES. Scientific Report No. 222. T. W. Speiser (Pennsylvania State Univ., University Park. Ionosphere Research Lab.). Oct. 10, 1964. Contract AF19(628)-4014. 156p. (AD-607268). $5.00(CFSTI).

A study of charged particle trajectories about a current sheet, based on Dungey's open model of the magnetosphere, is carried out to see whether charged particles incident on this current sheet, coming from the solar wind and emerging as possible auroral particles, emerge in any kind of complex spatial distributions resembling auroral forms. Adiabatic theory, which is good throughout most of the magnetosphere, breaks down near a neutral point in the current sheet, and particle trajectories must therefore be computed. The computation is done using an IBM-7074 computer. Only proton trajectories are studied extensively, and the results yield accelerated output protons with high

intensity in a thin sheet and perhaps some thin beam structure within the sheet. (auth)

29131 (ASE-608) ANALYSIS OF PERFORMANCE OF A ROCKET-BORNE RETARDING POTENTIAL ANALYZER. Final Report. Oscar P. Manley (American Science and Engineering, Inc., Cambridge, Mass.). May 1964. Contract AF19(604)-8849. 43p. (AFCRL-64-796; AD-607761). $2.00(CFSTI).

The use of a rocket-borne retarding potential analyzer (RPA) for determining positive ion densities in the ionosphere is studied. It is shown that at the altitudes of interest (40 to 90 km) shock ionization induced by the nose-cone may exceed ambient ionization. Moreover, the positive ion current measured by means of the RPA is not linearly dependent on the ion density; at present, the precise functional dependence between the two quantities cannot be established analytically. (auth)

29132 (NYO-1480-12) COLLISIONLESS SHOCKS AND SOLITARY WAVES. Cathleen S. Morawetz (Courant Inst. of Mathematical Sciences, New York Univ., N. Y.). Nov. 30, 1964. Contract AT(30-1)-1480. 12p. (MF-44; CONF-640804-2). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From International Congress of Applied Mechanics, Munich.

An idealized mathematical model is used to investigate the structure of collision-free magnetohydrodynamic shocks and solitary waves in the magnetosphere. It is assumed that the distribution functions for ions and electrons satisfy the Vlasov equation, and the electric and magnetic fields are governed by Maxwell's laws. (L.B.S.)

29133 (NYO-10221) RADIOLOGICAL MECHANISMS FOR GEOPHYSICAL RESEARCH. Annual Report. M. Bramson and C. A. Ziegler (Parametrics, Inc., Waltham, Mass.). Oct. 31, 1964. Contract AT(30-1)-2983. 32p. Dep.; $2.00(cy), 1(mn) CFSTI.

A prototype gage for in-situ measurement of suspended sediment concentration in rivers and streams was designed, constructed, and tested. The gage consists of two major components: a measuring head, approximately 8 × 12 × 30 in., capable of being mounted underwater on a wall or supporting pier; and a shore based unit, 12 × 12 × 14 in., containing electronics and readout. The gage measures sediment concentration between 500 and 50,000 ppm with an accuracy of ±20% at 1000 ppm and better at higher concentrations. The unit is capable of unattended operation for 7½ days powered by internal batteries. Sediment concentration is averaged and recorded at 15 minute intervals on paper tape. The operation of the gauge is based on measuring the ratio of the attenuation of x rays through the ambient water and through a reference cell containing distilled water. This ratio is a function of the ratios of the densities of the two liquids and therefore in the absence of an appreciable amount of dissolved material the ratio is a function of the concentration of suspended sediment in the ambient water. The x rays are provided by a radioisotope source, Cd-109, whose position is rapidly switched mechanically to allow attenuation measurements to be alternately made on the reference cell and on ambient water. This mode of operation eliminates errors that would otherwise be introduced due to decay of the radioactive source, secular drifts in the x-ray detector gain, and in the electronics, and changes in liquid density due to temperature. The radioisotope source strength is about 5 mc, and since most of the radiation emitted is in the form of easily shielded low energy x rays no special handling is required. Also, since Cd-109 is used an AEC license is required. The gage has been field tested and performance data are presented. (auth)

29134 (SU-SEL-64-063) WAVE PARTICLE GYRORESONANCE INTERACTIONS IN THE EARTH'S OUTER IONOSPHERE. Technical Report No. 3412-5. T. F. Bell (Stanford Univ., Calif. Stanford Electronics Labs.). May 1964. Contract AF49(638)-1060. 214p. (AFOSR-64-1908; AD-607379) $6.00(CFSTI).

An investigation is presented of certain aspects of those gyroresonance interactions which take place between very low frequency vlf electromagnetic waves and charged particle fluxes in the earth's outer ionosphere. These interactions, in which significant amounts of energy can be exchanged between the particle's kinetic energy form and the wave electromagnetic-energy form, are thought to be of importance with respect to the dynamical properties of the earth's outer ionosphere. Specifically two problems are considered. The first problem involves the stability of the outer ionosphere plasma to whistler-mode waves under conditions in which high-energy electron fluxes permeate this plasma. The second problem involves the feasibility of the creation or depletion of an artificial radiation belt utilizing the geocyclotron gyroresonance interaction in order to transfer energy between man-made waves and relativistic electrons trapped in the outer ionoshpere by the earth's magnetic field near the magnetic equatorial plane. (auth)

29135 (SC-T-65-728) MEASUREMENTS ON THE IONOSPHERE TEMPERATURE ON THE BASIS OF MOLECULAR FLUORESCENCE INDUCED ARTIFICIALLY BY MEANS OF ROCKETS. B. Authier. Translated by Marcel I. Weinreich (Sandia Corp., Albuquerque, N. Mex.), from Ann. Geophys., 20: 353-82(Oct.-Dec. 1964). 61p. Dep.(mn); $6.60(fs, $2.03(mf) JCL.

Rotation temperature and vibration temperature equal to kinetic temperature of the atmosphere are measured from photometric and spectroscopic observations performed on molecular clouds ejected by rockets from 120 to 210 km of altitude. The experiments take place at twilight; the fluorescence is observed from the ground. The method and the choice of the molecules are defined from theoretical consideration. After the failure of an emission of the radical CN, 3 firings producing clouds of the radical AlO are described. The photometry of the clouds demonstrates the feasibility of the temperature measurements, which are performed with 2 spectrographs. The rotation temperature is deduced from the P branch of the 0−0 band of the $A^2\Sigma^+$-$A^2\Sigma^+$ transition of AlO. At 120 km, $\theta°K = 200^{+100}_{-50}$ and at 170 km $\theta°K = 730$ (±100). The vibration temperature is deduced from the relative intensity of band heads of the $\Delta\nu = +1$ and $\Delta\nu = -1$ sequences of the same transition. At 170 km: $\theta°K = 750 \pm 150$, and 210 km: $\theta°K = 1250 \pm 150$. The methods described have been confirmed by results obtained on several subsequent firings. (auth)

29136 ELECTRIC CURRENTS INDUCED IN AN ANISOTROPIC IONOSPHERE. G. A. J. Ferris and A. T. Price (Univ. of Leeds, Eng. and Univ. of Exeter, Eng.). Geophys. J., 9: 285-308(Apr. 1965).

Transient variations of the geomagnetic field arising outside and beyond the lower layers of the ionosphere induce electric currents in these layers which considerably modify the field changes observed at the Earth's surface. To further the knowledge of the variations and of the properties of the ionosphere, it is useful to calculate the modifications to be expected for various model ionospheres. The present work extends previous calculations by taking into account the main geomagnetic field, which renders the ionospheric conductivity anisotropic. One important effect of the anisotropy, first found by Ashour and Ferraro, is that any current distribution in the ionospheric shell tends to rotate about the magnetic dipole axis. In the case of periodic variations it is found that this can lead to a resonance phenomenon, which will be important if the Hall current conductivity is sufficiently large. Hence, the usual idea that the ionosphere shields the Earth from magnetic field fluctuation outside it is not entirely valid. For certain frequencies the ionospheric currents may even amplify these fluctuations. (auth)

29137 THE GEOMAGNETIC EFFECTS OF ENERGY DENSITY VARIATIONS IN THE SOLAR WIND. D. M. Willis (Dept. of Scientific and Industrial Research, Slough, Bucks, Eng.). J. Atmospheric Terrest. Phys., 27: 433-50(Apr. 1965).

The geomagnetic effects which result from a small, sinusoidal modulation of the energy density of the solar wind impinging on a model one-dimensional magnetosphere

are investigated. Most of the energy in low-frequency hydromagnetic waves in the magnetosphere is thought to be reflected at the level of the maximum in the hydromagnetic wave velocity. With this assumption it is shown that the periodic variation in solar particle pressure on the interface between the magnetosphere and the solar wind generates a satisfactory hydromagnetic wave in the magnetosphere. The properties of this hydromagnetic wave are examined in detail. In particular, it is found that the wavelength of the sinusoidal variation in energy density of the solar wind must be of order 1000 earth radii for the wavelength of the stationary hydromagnetic wave to be comparable with the dimensions of the magnetosphere. The results are discussed briefly in connection with theories of micropulsations and particle precipitation. (auth)

29138 IONOSPHERIC TEMPERATURES AT SUNSPOT MINIMUM. J. E. Geisler and S. A. Bowhill (Univ. of Illinois, Urbana). J. Atmospheric Terrest. Phys., 27: 457-74(Apr. 1965).

The temperature profile throughout the ionosphere is determined by the relative importance of the following processes: the rate of heat input to the ambient electron gas by Coulomb scattering of photoelectrons; the rate of transfer of heat from the electron gas to the neutral atmosphere; heat conduction by the electron gas. Theoretical temperature profiles were obtained by Dalgarno and by Hanson under the assumption of no heat conduction. These profiles show a departure from thermal equilibrium beginning at about 120 km, the electron temperature reaching a maximum near 225 km, with thermal equilibrium again being established in the region at and above 350 km. A numerical solution of the electron conduction equation is described, and it is shown that the electron temperature increases monotonically above the 120 km level for a model approximating conditions near sunspot minimum. The failure of the electron temperature to decrease to that of the neutral atmosphere above 200 km is attributed to the low electron density at sunspot minimum and consequent inefficiency of heat transfer to the neutral atmosphere. The temperature profiles of Dalgarno and of Hanson might be expected to be representative of conditions near sunspot maximum when the electron density is high. Scaling of the relevant parameters in the present work to approximate sunspot maximum conditions confirms this expectation. (auth)

29139 RADIO WAVE EMISSIONS IN THE V.L.F.-BAND OBSERVED NEAR THE AURORAL ZONE. I. OCCURRENCE OF EMISSIONS DURING DISTURBANCES. Leiv Harang (Norwegian Defence Research Establishment, Kjeller) and Reidulv Larsen. J. Atmospheric Terrest. Phys., 27: 481-97(Apr. 1965).

Very-low-frequency emissions in the 8 kc/s-band were recorded at the Auroral Observatory, Tromsö, and bursts of enhanced emissions were compared with geomagnetic records, absorption effects recorded on a riometer and appearance of auroras. It is shown that bursts of enhanced radiations in the 8 kc/s-band appear regularly during disturbed conditions near the auroral zone, the energy is of the order $1-10 \times 10^{-16}$ W/m^{2}c. The occurrence of the bursts exhibits a pronounced diurnal variation, their occurrence is limited to the time interval 1800–2400 hours M.E.T. The average duration of the bursts may vary from one minute to several hours, with a minimum occurrence of 10–12 min duration. The v-l-f-emissions show a complicated dependence on geomagnetic disturbances and absorption within the ionosphere. Small dips of absorption in the riometer curves of the order 0.3–0.9 dB may be accompanied by v-l-f-emissions; there is a positive correlation. Great values of absorption of the order 5–9 dB are accompanied by a complete cessation of v-l-f-emission; there is a negative correlation. These two effects indicate conclusively that the v-l-f-emissions are strongly absorbed in a disturbed ionosphere. The moderate positive geomagnetic disturbances in H appearing early in the night (which is often followed by quiet auroral forms, arcs and bands on the Northern sky) are very often accompanied by strong v-l-f-emissions. Sudden and strong disturbances in the geomagnetic field when these appear as a sudden commencement, are usually followed by a pronounced v-l-f-emission. When the disturbance develops with (usually negative) peaks in H the v-l-f-emissions are completely absorbed. It is pointed out that the close connection between the v-l-f-emissions and the geomagnetic disturbances is limited to appear only in the time interval 1800–2400 hours M.E.T. Outside this 6-hr interval v-l-f-emissions do not appear independently of the degree of geomagnetic disturbances, auroral luminosities or level of ionospheric absorption. The point of view that the v-l-f-emissions are generated in the near and local part of the ionosphere by an impact of charged particles (for instance as Cherenkov-radiation) which simultaneously are producing auroral luminosities, must therefore be regarded as less probable. If this were the case, one would expect an appearance of v-l-f-emissions throughout the whole night. Records demonstrating the parallel amplitude variations in v-l-f-emissions and 5577 Å-photometer recordings are shown. Parallel records of v-l-f-emissions were made at Tromsö and Kiruna, the latter lying 210 km to the South of Tromsö. In some cases the Kiruna records show similar changes in amplitudes for great bursts as the Tromsö-records. Three cases of "noise storms" were recorded during which the enhanced v-l-f-radiations appeared during the whole night, the "noise storms" coinciding with large geomagnetic disturbances. The amplitude of the "storm" declined and disappeared when the ionosphere was illuminated by the sun's rays in the morning and when the normal day-time absorption was formed. Several cases of enhanced radiation are presented on the riometer recording frequency of 28 Mc/s. Records are shown which demonstrate coincidence between v-l-f-bursts on 8 kc/s and sudden increases in the normal galactic noise level received on 28 Mc/s. These common bursts appear only when a sudden deflection in the geomagnetic curves appears, which may often have the character of a sudden commencement. The 28 Mc/s bursts are rare events, but it is concluded that the bursts are not produced by man-made interference. (auth)

29140 RADIO WAVE EMISSIONS IN THE V.L.F.-BAND OBSERVED NEAR THE AURORAL ZONE. II. THE PHYSICAL PROPERTIES OF THE EMISSIONS. Leiv Harang (Norwegian Defence Research Establishment, Kjeller) and Knut N. Hauge. J. Atmospheric Terrest. Phys., 27: 499-512(Apr. 1965).

The direction of arrival of the v-l-f-emission in the 8 kc/s bands was studied using two crossed loops with their planes lying in EW and NS directions, and by switching the loops alternately to the same amplifier channel. The v-l-f-noise level was higher in the EW than in the NS direction, and this higher EW noise level was maintained during day and night for a year and also independently at two observing places lying 35 km apart. The v-l-f-bursts came in on both frames with amplitudes of the same order of magnitude. It is concluded that Tromsø is lying within an area of arrival of the v-l-f-emissions, and that the energy is coming in from all directions. This point of view is confirmed by the polarization studies. The v-l-f-emissions were picked up on two crossed frames, each of which was connected to identical amplifiers and displayed on the pairs of X, Y-plates on an oscillograph. Ordinary broad and irregular v-l-f-bursts showed an irregular oscillograph pattern with changing amplitudes and irregularly appearing reversals of the sense of rotation. The oscillograph patterns are to be explained by the simultaneous arrival of several v-l-f-noise trains which are uncorrelated. In some few cases when a sudden and single, sharp burst appeared the oscillograph pattern was different, the pattern was almost circular and the sense of rotation was always in the same direction. In this case it is assumed that the emission came down vertically along the field lines, circularly polarized, and only in the extraordinary mode. Examples of amplitude distribution are demonstrated in which a strong v-l-f-emission is being built up by a series of sudden, discrete trains of bursts which gradually merge together into a continuous emis-

sion. The frequency-analysis of a number of bursts in the range 5–13 kc/s is demonstrated. It seems to be a general rule that at the start of a burst the higher frequency amplitudes on 12–10 kc/s are stronger, while at the end of a burst the lower frequency 6–5 kc/s is the strongest. A possible explanation of this effect is the gradual building-up of an absorption in the E-layer during a disturbance, which in the beginning will influence the higher frequencies more strongly than the lower. The mechanisms of generation of the continuous band-emission, Cherenkov- and gyroradiations are discussed, and it is concluded that the observations do not give any decisive proof for either of the two hypotheses. It is pointed out that the diurnal curve of occurrence of the v-l-f-emissions at Tromsø (the appearance being limited to the interval 1800–2400 hours M.E.T.) is difficult to explain, and some more extended series of observations are needed at various places along the auroral zone. (auth)

29141 A STUDY OF AURORAL ZONE IONOSPHERIC IRREGULARITIES MADE SIMULTANEOUSLY AT TROMSO, NORWAY AND KIRUNA, SWEDEN. Jon Frihagen (Norwegian Defence Research Establishment, Kjeller) and Ludwik Liszka. J. Atmospheric Terrest. Phys., 27: 513-23(Apr. 1965).

The results of observations of satellite scintillation at 54 Mc/s made simultaneously at Tromsö, Norway (70°N, 19°E), and Kiruna, Sweden (68°N, 20°E), using sets of spaced receivers, are reported. In most cases the height and the thickness of the layer producing scintillation were the same at both stations. A type of fast and very regular fading observed at both stations is discussed. (auth)

29142 AN ASSOCIATION BETWEEN SPORADIC-E AND THE EARTH'S MAGNETIC FIELD. G. L. Goodwin (Univ. of Queensland, Australia). J. Atmospheric Terrest. Phys., 27: 535-41(Apr. 1965).

A positive correlation was found between changes, over short time intervals ≈15 min, in the horizontal component (H) of the earth's magnetic field near Brisbane, and in the amplitude of direct backscatter ($E_{s\phi}$) echoes from the constant-height sporadic-E (E_{sc}) region some 150 km away. $E_{s\phi}$ echo amplitudes and the occurrence of E_{sc} echoes at vertical incidence were found to be positively correlated. These observations suggest a positive correlation between changes in H and in occurrence of vertical incidence E_{sc} echoes, which is consistent with Whitehead's wind shear theory for the production of temperate zone sporadic-E. In contrast, Wilkie and McNicol reported a negative correlation between observations, at the same site, of H and sporadic-E occurrence over long time intervals ≈6 hr. The latter results are consistent with Cole's mechanism of E_s-layer formation. (auth)

29143 DISPERSION OF WAVES IN A COLD MAGNETOPLASMA FROM HYDROMAGNETIC TO WHISTLER FREQUENCIES. Henry G. Booker (Cornell Univ., Ithaca, N. Y.) and Rolf B. Dyce. J. Res. Natl. Bur. Std., 69D, 463-92(Apr. 1965).

It is shown that dispersion of waves in the magnetosphere regarded as a cold plasma may conveniently be handled from whistler frequencies down to frequencies small compared with the ionic gyrofrequency by an approximation similar to the Appleton-Hartree approximation used at radio frequencies. In both cases the ratio of the ionic mass to the electronic mass is assumed to be infinite, but whereas for the radio approximation this is achieved by taking the ionic mass infinite, it is achieved for the hydromagnetic approximation by taking the electron mass zero. This permits extension of the concept of quasi-longitudinal and quasi-transverse approximations to the entire frequency spectrum; propagation is predominantly quasi-transverse at frequencies small compared with the ionic gyrofrequency. The directional pulse patterns for radiation of a pulse from a source are calculated and the transition from the omnidirectional MHD wave to the whistler mode is illustrated. The hydromagnetic approximation used facilitates detailed calculation of elliptical polarization and space-charge. Attenuation due to ionic collisions with neutral gas is calculated on the assumption that the neutral gas is too massive to take part in the wave motion. (auth)

29144 STUDY ON THE GUIDING MECHANISM OF WHISTLER RADIO WAVES. Saburo Adachi (Tohoku Univ., Sendai). J. Res. Natl. Bur. Std., 69D, 493-502(Apr. 1965).

A full-wave theory is applied to the whistler radio wave propagation along a plasma slab with an enhanced or depressed plasma density which is imbedded in an infinite magnetoplasma. A rigorous dispersion equation is solved for a thin slab in approximate but explicit forms. Three types of propagation modes are found: a completely trapped surface wave mode along the depressed slab in the frequency region above half the gyrofrequency and below the gyrofrequency, a completely trapped surface wave mode along the highly enhanced slab in the frequency region above half the gyrofrequency and below a certain cutoff frequency less than the gyrofrequency, and a partially trapped (leaky) surface wave mode along the enhanced slab in the frequency region above a certain cutoff frequency and below half the gyrofrequency. Dispersion properties, field distributions and an attenuation of the third mode due to the leakage of the transmitted power are discussed in detail. The attenuation is found to increase very rapidly with increasing frequency, thickness, and enhancement of ionization of the slab. The exact numerical solutions are also obtained and compared with the approximate solutions. (auth)

29145 USE OF THE PHASE-INTEGRAL METHOD TO DETERMINE THE REFLECTION PROPERTIES OF A STRATIFIED IONOSPHERE. C. Altman (Dept. of Scientific and Industrial Research, Slough, Bucks, Eng.). J. Res. Natl. Bur. Std., 69D: 511-19(Apr. 1965).

A Pegasus computer was programmed to give the absorption coefficients and virtual heights at vertical incidence for the main magneto-ionic components reflected from a stratified ionosphere, using the phase-integral method. Typical absorption and virtual height curves are given for daytime ionospheric models. For high geomagnetic latitudes the Z-trace is shown to be one of the two least attenuated traces for daytime E-layer reflections at frequencies both above and below the gyrofrequency, and it is shown that under certain circumstances the Z-trace may appear at a lower virtual height than the O-trace. The limitations of the usual ray method which uses the group refractive index for determining virtual heights are discussed, and it is shown that a simple correction term may be added to the ray theory calculation of virtual heights to make it agree with the phase-integral determination. (auth)

29146 E-MODE PROPAGATION IN A PLANE-STRATIFIED PLASMA. Peter Hirsch (Bell Telephone Labs., Inc., Whippany, N. J.) and Jerry Shmoys. J. Res. Natl. Bur. Std., 69D: 521-7(Apr. 1965).

The problem of propagation of plane electromagnetic waves polarized in the plane of incidence in a plane-stratified isotropic plasma (regarded as a dielectric) is dealt with by reducing it to the solution of an ordinary differential equation which is singular at the level of plasma resonance. The absorption of power in the resonant layer is calculated approximately in two cases involving a linear profile. In the first, the relative dielectric constant varies linearly in a thin transition layer between two homogeneous regions. In the second, the dielectric constant varies linearly over a large interval. (auth)

29147 MEASUREMENTS OF THE INTENSITY AND SPECTRUM OF SOFT ELECTRON FLUX IN IONOSPHERE AT 200 TO 500 km. L. A. Antonova. Kosmich. Issled., 3: 89-101(Jan.-Feb. 1965). (In Russian)

A method is set forth for reducing the data from the experiment [Kosmich. Issled., 3: 82-8(Jan.-Feb., 1965)] and an interpretation is advanced for the results obtained on the average electron flux intensity values. On the average, the electron flux is 5×10^7 cm^{-2} · sec^{-1} · steradian^{-1} and carries an energy of ~0.1-0.6 erg · cm^{-2} · sec^{-1} · steradian^{-1}. For electrons of $\gtrsim 10$ kev, the spectrum is power-law with the exponent $\gamma \approx 5.5$. The lower boundary of the spectrum is below 8 kev. (tr-auth)

29148 AN ELECTROSTATIC FLUXMETER DESIGNED FOR MEASUREMENT IN THE UPPER LAYERS OF THE ATMOSPHERE. G. L. Gdalevich, I. M. Imyanitov, and Ya. M. Shvarts. Kosmich. Issled., 3: 102-10(Jan.-Feb. 1965). (In Russian)

A noise-stable instrument for measuring electrostatic field strengths in the upper layers of the atmosphere is described. The block diagram and schematic electrical diagram of the instrument are presented. The design of the sensor is described. The instrument's range of measurement is ± 2-3 v $\cdot$ cm^{-1} and its measurement error is ± 0.25 v $\cdot$ cm$^{-1} \pm 0.25 E_{izm}$. (tr-auth)

29149 INTENSITY OF RADIATION BELT ELECTRONS AT AN ELEVATION OF 180 TO 330 km REGIONS CONJUGATED WITH NEGATIVE GEOMAGNETIC ANOMALIES. S. N. Vernov, I. E. Savenko, L. V. Tverskaya, B. A. Tverskoi, and P. I. Shavrin. Kosmich. Issled., 3: 128-34(Jan.-Feb. 1965). (In Russian)

According to data obtained from the 2nd and 3rd Soviet orbiting spacecraft, the asymmetry of the electron intensity of the radiation belts was investigated at conjugate points for the case in which one of these points is situated beneath the ground. The intensity of such points was investigated in the northern hemisphere in the region conjugate to the South Atlantic anomaly, and in the southern hemisphere, in the region conjugate to the Bering anomaly. An estimate of particle leakage with consideration of this phenomenon is presented, and the problem of the limits of applicability for the concept of the mirror point of a particle is discussed, with consideration of Coulomb scattering. It is demonstrated that the dense layers of the atmosphere can in all probability reflect electrons with small pitch angles. The effect of intensity asymmetry is most likely associated with the processes of particle acceleration at low altitudes. If the observed counting rate is due to the bremsstrahlung of electrons with energies $\leq$50-100 kev, the effect may be explained by the Coulomb diffusion of particles from the outer radiation belt. (tr-auth)

29150 DIRECT MEASUREMENTS OF CHARGED PARTICLE CONCENTRATIONS IN THE STRATOSPHERE AND MESOSPHERE. Yu. A. Bragin. Kosmich. Issled., 3: 168-72(Jan.-Feb. 1965). (In Russian)

Two experiments for measuring the electron and ion concentrations in the stratosphere and mesosphere are described, and the results are summarized. (C.E.S.)

29151 HYDROMAGNETIC INSTABILITIES CAUSED BY A GYRATING PROTON STREAM. Jacob Neufeld and Harvel Wright (Oak Ridge National Lab., Tenn.). Nature, 206: 499-500(May 1, 1965). (ORNL-P-1086)

The collective effect is investigated for the generation of hydromagnetic instabilities. It is assumed that hydromagnetic waves result from an instability which occurs when a helical proton stream in a Van Allen belt interacts with the surrounding exospheric plasma. Expressions are obtained for the frequencies and growth rates of P- and B-instabilities, using the dispersion equation for the plasma stream system; and it is shown that the P-waves occur at two discrete frequencies, in contrast to B-waves which have frequencies continuously distributed in two frequency ranges. (L.B.S.)

29152 EFFECT OF IONIZATION TRANSPORT ON THE EQUATORIAL F-REGION. R. J. Moffett and W. B. Hanson (Southwest Center for Advanced Studies, Dallas). Nature, 206: 705-6(May 15, 1965).

The steady-state continuity equation for the electron number density in the equatorial F-region was solved numerically, incorporating a drift in an upward direction perpendicular to the magnetic field lines and of any magnitude greater than zero. The results indicate that the Appleton anomaly can be explained by this approach. (D.C.W.)

29153 MEASUREMENTS OF ION CONCENTRATIONS IN THE D-REGION OF THE IONOSPHERE WITH A GERDIEN CONDENSER ROCKET PROBE. A. Pedersen (Research Inst. of National Defence, Stockholm). Tellus, 17: 1-45(Feb. 1965).

The development of a Gerdien condenser rocket system for measurements of ion concentrations in the ionospheric D-region is described. The Gerdien condenser and the instrumentation connected to it is separated from the rocket close to the top of the rocket trajectory, and the measurements are done during the descent with the instrumentation hanging under an inflatable parachute. Data from the first launchings at White Sands Missile Range indicate that the concentration of positive ions is of the order of 10^4 cm^{-3} and that the concentration of negative ions is of the order 10^3 cm^{-3} in the height range of 50–70 km. This indicates that heavy negative ions, which cannot be collected by the Gerdien condenser, most probably are present in the same height range. Heavy negative ions may be formed in chemical reactions or in clustering processes. Recombination to dust seems to be important below 50 km. This may be due to high dust concentrations above the launch site or dust layers from volcano eruptions observed at the time of the rocket firings. (auth)

29154 A MONTE CARLO STUDY OF TIME-DEPENDENT GAMMA-RAY TRANSPORT IN THE ATMOSPHERE. J. Brooks, A. D. Krumbein, and R. Ross (United Nuclear Corp., Chappaqua, N. Y.). Trans. Am. Nucl. Soc., 8: 195-6(May 1965).

29155 A MODEL CONCEPT FOR THE AURORAL AFTERGLOW AND THE PINK AFTERGLOW. H. H. Broemer and F. Doebler (Technische Hochschule, Brunswick). Z. Physik, 185: 278-94(1965). (In German)

Based on measurements of the decay of light intensity and electron density, a simple model for the auroral afterglow and the pink afterglow is proposed. To a certain extent the model can account for the influence of pressure and tube diameter on the behavior of the afterglow. The first decay of the electron density towards the first minimum seems not to be influenced by creation processes for electrons during 3 to 15 ms. Therefore, the first decay can be used to measure the neutralization processes of electrons and positive ions. At pressures lower than 3 torr the electrons are removed by ambipolar diffusion with a rate given by $D_a \cdot p \approx 2100$ torr $\cdot$ cm$^2 \cdot$ s^{-1}. From this value an electron temperature of about 7200°K could be derived. Assuming that ambipolar diffusion will remain the dominant loss process the time dependence of the electron creation rate was evaluated. At a pressure of 1.75 torr the maximum electron creation rate was 4×10^{12}s$^{-1} \cdot$ cm^{-3}. At the same time the emission density rate of the first negative bands was found to be 2.7×10^{13} cm^{-3}s^{-1}. During one decay process about five times more electrons are created than the initial number. To explain the proportionality found between the electron density and the emission of the first negative bands, it is assumed that the ions, presumably N_2^+-ions, are repeatedly excited to the $B^2\Sigma_u^+$-state by metastables. (auth)

Low Temperature Physics

Refer also to abstract 28962.

29156 (NYO-2150-4) NMR CALIBRATION OF SUPERCONDUCTING MAGNETS. Report No. 321. B. W. Maxfield and J. R. Merrill (Cornell Univ., Ithaca, N. Y. Materials Science Center). Feb. 17, 1965. Contract AT (30-1)-2150. 17p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

A method is given for absolute calibration for low-homogeneity, superconducting solenoids for fields up to 85kG. The method utilizes nuclear magnetic resonances at r-f frequencies up to 95Mc. Also reported are some measurements of hysteresis in a superconducting solenoid which were made using this technique. (auth)

29157 NUCLEAR MAGNETIC RESONANCE MEASUREMENTS IN SOLID He^3. M. G. Richards, J. Hatton, and R. P. Giffard (Oxford Univ.). Phys. Rev., 139: A91-103(July 5, 1965).

Measurements of the magnetic susceptibility of solid ^{3}He are complicated by the nature of the coupling of the spin system to the lattice. This coupling is examined at temperatures down to 0.1°K, magnetic fields up to about 2 kG,

and molar volumes between 18.5 and 24 cm^3 using a continuous-wave NMR apparatus. For pure ^3He, the three-bath model of Garwin and Landesman gives a good description of the way in which the spins achieve equilibrium with the lattice. By measuring the various relaxation times, values of the exchange integral are derived by several different methods with good internal consistency. Values of the exchange-bath specific heat very close to the calculated values are observed. Values of the exchange-lattice relaxation time were measured over the same wide range of temperature and molar volume, and values very different from the results of Garwin and Reich were found. This and their large discrepancy between observed and calculated exchange-bath specific heats are believed to be due to the presence of about 1% ^4He in their samples. In the bcc phase, over certain temperature regions, diffusion appears to be the dominant coupling process, and values of the self-diffusion coefficient are calculated which suggest that the diffusion process is thermally activated at values down to at least 10^{-16} cm^2 sec^{-1}. Experiments on samples containing 0.5% ^4He show that the presence of small amounts of ^4He impurity affects very strongly certain parameters in the three-bath model, and concentrations as low as 0.05% are detectable by their effect on the exchange-bath specific heat. Also in the impure samples a new long relaxation time appears below 0.7°K, which we believe was incorrectly identified as the exchange-lattice relaxation time by Garwin and Reich and which was the cause of nonequilibrium between spins and lattice in the magnetic susceptibility experiments of Adams, Meyer, and Fairbank. (auth)

29158 TRANSPORT EQUATIONS FOR SUPERCONDUCTORS. M. J. Stephen (Yale Univ., New Haven). Phys. Rev., 139: A197-205(July 5, 1965).

Using the microscopic theory of superconductivity due to Bardeen, Cooper, and Schrieffer, transport equations, analogous to the Boltzmann transport equation for normal metals, are developed for superconductors. The damping is assumed to arise from collisions of the electrons with randomly distributed impurities. The collisions are treated in the Born approximation. By making suitable assumptions about the solutions to the transport equation, the two-fluid model of a superconductor is derived. The response of a superconductor to various driving forces is investigated, giving expressions for the phenomenological relations and thermal conductivity of a superconductor. (auth)

29159 RATIO OF THE LATTICE THERMAL CONDUCTIVITIES OF NORMAL AND SUPERCONDUCTING INDIUM. P. Lindenfeld and H. Rohrer (Rutgers Univ., New Brunswick, N. J.). Phys. Rev., 139: A206-11(July 5, 1965).

Measurements are reported of the thermal conductivity of ten specimens of indium with small amounts of tin and bismuth, with residual resistivities between 0.12 and 6 $\mu\Omega$ cm. The normal-state lattice conductivity shows the characteristic variation with electronic mean free path previously reported for other metals. The ratio of the lattice conductivities in the superconducting and normal states in the region where electron scattering predominates is in reasonable agreement with the theoretical predictions of Bardeen, Rickayzen, and Tewordt. (auth)

29160 GYROSCOPIC DETECTION OF PERSISTENT FLOW OF SUPERFLUID LIQUID HELIUM. J. B. Mehl and W. Zimmermann, Jr. (Univ. of Minnesota, Minneapolis). Phys. Rev. Letters, 14: 815-18(May 17, 1965).

The superfluid flow of liquid helium was studied in a glass sphere which contained silica powder and was suspended from a torsion fiber in liquid helium. The deflection of the suspension (proportional to the fluid angular momentum) upon application of a vertical magnetic field was measured. Long-lived persistent currents were observed, and it was found that the amount of angular momentum present could be changed reversibly by warming and cooling. (D.C.W.)

29161 OBSERVATION OF THE MARTENSITIC TRANSFORMATION IN SUPERCONDUCTING V_3Si BY TRANSMISSION ELECTRON MICROSCOPY. M. J. Goringe and U. Valdre (Cambridge Univ., England). Phys. Rev. Letters, 14: 823-4(May 17, 1965).

The existence of the martensitic phase transformation in V_3Si was confirmed by transmission electron microscopy in the temperature range from 20 to 30°K. (D.C.W.)

29162 EXPERIMENTAL DETECTION OF TRANSITION OF He^3 TO THE SUPERFLUID PHASE. V. P. Peshkov (Inst. of Problems in Physics, Academy of Sciences, USSR). Zh. Eksperim. i Teor. Fiz., 48: 997-1012(Apr. 1965). (In Russian)

An instrument with three-stage demagnetization of paramagnetic salts is built in which tin superconducting switches are employed. The temperature dependence of the thermal capacity of liquid ^3He is determined with help of the instrument at temperatures between 0.0035 and 0.015°K. At temperatures of 0.005–0.006°K the specific heat of ^3He was found to increase by almost twice the value expected on the assumption of a linear dependence on temperature. The results can be explained by assuming transition of ^3He to the superfluid phase at 0.0055°K. (auth)

29163 A STUDY OF THE ANISOTROPY OF THE ENERGY GAP IN SUPERCONDUCTING TIN. A. G. Shepelev and G. D. Filimonov (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zh. Eksperim. i Teor. Fiz., 48: 1054-61(Apr. 1965). (In Russian)

New experimental data are presented on electron absorption of ultrasound with a frequency up to 300 Mc in a pure tin single crystal at temperatures between 1 and 4°K. The directions of the sound wave vector are perpendicular to all crystallographic planes with smallest indices. In this way values of the energy gap in the electron spectrum of superconducting tin are obtained which can be employed for constructing the anisotropy pattern of the gap on the Fermi surface. Comparison of all the experimental data shows that the magnitude of the anisotropy of the energy gap of this superconductor is ~70%. (auth)

29164 EFFECT OF IMPURITIES ON THE DEPENDENCE OF THE SUPERCONDUCTIVITY TRANSITION POINT IN THALLIUM. B. G. Lazarev, L. S. Lazareva, V. I. Makarov, and T. A. Ignateva (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zh. Eksperim. i Teor. Fiz., 48: 1065-70(Apr. 1965). (In Russian)

The effect of valency and impurity concentration on the shift of the superconductivity transition temperature in thallium produced by pressure is investigated. It is found that even small Bi, Sb or Hg impurity concentrations are sufficient to change the pressure effect sign in thallium which thus becomes negative. The results obtained yield a complex energy dependence of the electron state density near the Fermi surface. Evidently, a sharp change in the energy spectrum of thallium conductivity electrons due to the impurities is observed. (auth)

29165 ENERGY FLUCTUATIONS AND THE NATURE OF THE ROTONS IN HELIUM II. O. K. Rice (Univ. of North Carolina, Chapel Hill). 5p. (CONF-651-67)

From 9th International Conference on Low Temperature Physics, Columbus, Ohio, Aug.-Sept. 1964.

Energy fluctuations in He II near 1°K are treated as fluctuations in roton density. Gradients in roton density are considered as gradients in temperature, causing accelerations of the superfluid relative to the normal fluid. It is proposed to identify the roton energy as a function of momentum with the kinetic energy of the fluctuations. The nature of rotons, involving atoms with varying velocities, is described. A swarm of rotons is considered, and equations are found for the average drift velocity relative to superfluid and for the average roton kinetic energy and the extra kinetic energy due to drift. (M.J.T.)

Neutron Physics

See also REACTOR TECHNOLOGY — Criticality Studies.

Refer also to abstracts 28258, 28944, 29337, and 29505.

29166 (CONF-650501-3) SOME NEW NONLINEAR ITERATION TECHNIQUES FOR SOLVING NEUTRON

DIFFUSION PROBLEMS. Eugene L. Wachspress (Knolls Atomic Power Lab., Schenectady, N. Y.). Feb. 1965. Contract W-31-109-eng-52. 9p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From the Application of Computing Methods to Reactor Problems, Argonne, Ill.

Variational principles provide a basis for nonlinear acceleration of linear iterative methods for solving linear equation systems occurring in neutron diffusion computations. The outer iteration on the fission neutron source is used to solve the homogeneous (eigenvector) coupled-group diffusion equations, and an inner iteration procedure is applied to solve the inhomogeneous (fixed source) diffusion equation for each group of every outer iteration. Equations for computing the coefficients of the vector $\underline{y}$ for the fundamental neutron flux mode of discrete coupled-group diffusion equations are found, using direct and adjoint approximations and partitioning the n-space of $\underline{y}$. Application of the method to the inner and outer iterations in the NOVA program is described, and a sample NOVA two-space-dimension neutron-diffusion computation is outlined. (M.J.T.)

29167 (CONF-650505-2) RECENT ADI THEORY AND RESULTS FOR ELLIPTIC EQUATIONS. E. L. Wachspress (Knolls Atomic Power Lab., Schenectady, N. Y.). [1965]. Contract W-31-109-eng-52. 9p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From IFIP Congress 1965 Meeting, New York.

Recent alternating-direction iteration theory and numerical results previously obtained with the FAST program are discussed. (L.B.S.)

29168 (FZK-199) COLD-NEUTRON SCATTERING CROSS SECTION OF LIQUID HYDROGEN BASED ON A CONSISTENT-VIBRATIONS LIQUID MODEL. H. G. Carter (General Dynamics/Fort Worth, Tex.). Mar. 1965. Contract AF29(601)-6213. 60p. (WL-TR-64-161)

Expressions for the elastic and inelastic slow-neutron cross sections of liquid hydrogen are derived, with liquid effects accounted for on the basis of a harmonic oscillator model. It is assumed that the molecules can be regarded as rigid rotators, the centers of mass of which execute quantized harmonic motions about central sites in a liquid quasilattice. A consistent-vibrations liquid model provides the state-dependent vibration parameters and the neighbor distributions resulting from thermal disorder. The derived cross sections may be divided into diffuse and interference parts. Insofar as the molecular motion conforms to a system of independent oscillators, the inelastic scattering—which may result from rotational molecular excitation, from excitation of a quantum level of the center-of-mass motion, or from both processes simultaneously—is purely incoherent. The interference scattering is found to be independent of the relative concentrations of para- and ortho-hydrogen. Calculated para-hydrogen cross sections for various inelastic processes associated with the scattering of 0.065-ev neutrons through 90° are compared with a published experimental spectrum. For final neutron energies above 0.02 ev, the calculated results are decidedly better than those based on a perfect-gas model. (auth)

29169 (GA-6281) CALCULATION OF THERMAL SCATTERING KERNELS. James A. Young and J. U. Koppel (General Atomic, San Diego, Calif.). Apr. 5, 1965. Contract AT(04-3)-167. 27p. (CONF-650504-7). Dep.(mn); $2.00(cy), 1(mn) CFSTI.

From IAEA Symposium on Pulsed Neutron Methods, Karlsruhe, Ger.

A review is presented of the recent development of physical models to describe the scattering of slow neutrons from the various moderators, and the numerical methods necessary for the computation of thermal neutron cross sections and scattering kernels for the moderators Be, C, H_2O, D_2O, CH_2, H_2, and D_2. For the moderators Be and C in particular, accurate phonon spectra obtained by the root sampling technique are presented, along with comparisons to demonstrate how well the scattering models can predict the results of cross-section and spectral measurements. While the treatment of H_2O is essentially that of Nelkin, curves of calculated and experimental neutron spectra are shown which demonstrate that the inclusion of anisotropic effects for the molecular vibrations improves the agreement between theory and experiment. Following Butler's description of neutron scattering by D_2O, a scattering kernel was obtained that quite accurately predicts integral quantities such as neutron spectra and angular as well as total scattering cross sections. An interesting result of the curves shown is that the inter- and intramolecular interference effects tend to cancel so that an incoherent approximation is quite adequate to calculate neutron spectra in D_2O for the case of infinite media or weakly space-dependent problems. By utilizing the treatment by Lin and Koenig of the vibrational modes of infinite CH_2 chains, a scattering kernel was obtained that results in very good agreement between the predicted and experimental total cross-section and neutron spectra. Curves are presented to demonstrate this agreement between theory and experiment. Neutron spectra were calculated for liquid hydrogen at boiling using a very accurate scattering description. These spectra are shown to be very sensitive both to geometry and to the scattering model. (auth)

29170 (IEA-78) I.E.A. NFUTRON VELOCITY SELECTOR THEORY AND CALIBRATION. F. G. Bianchini, M. Abreu, L. Q. Amaral, and O. W. Martins (Instituto de Energia Atômica, São Paulo (Brazil)). Nov. 1964. 22p. (CONF-631104-5). Dep.(mn).

From the Meeting on the Utilization of Research Reactors, São Paulo, Brazil.

A mechanical velocity selector (MVS) with helical channels, for the monochromatization of slow neutrons, was built at the Instituto de Energia Atômica. The selector was installed at a tangential beam hole in the swimming pool reactor. The channel rotation velocity determines the emergent neutron energy. This instrument is used as a low resolution monochromator and as a filter for higher order neutrons reflected by crystals. The finite dimensions of the channel lead to a nonmonochromatic transmitted spectrum. The average wavelength of the MVS is compared with ideal MVS wavelength, and a relation between them is established. The transmission function of the selector is determined. Experimental verification of the calculated wavelengths was made by analyzing the emergent spectrum of the selector with a crystal spectrometer. Measurement of the cross section of gold with the neutron spectrometer coupled to the velocity selector shows its use for the elimination of effects due to high order reflections. (auth)

29171 (JPL-TR-32-686) A NEW APPROACH TO THE HOMOGENIZATION OF HETEROGENEOUS MEDIA FOR NEUTRON DIFFUSION CALCULATIONS. Alan M. Jacobs (Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena). Apr. 15, 1965. Contract NAS 7-100. 26p.

The mathematical formulation of a new approach to the homogenization of certain types of heterogeneous media (such as a regular array of holes in a scattering media) for the purpose of neutron diffusion calculations is developed. The method is based on the inclusion of an angular-dependent mean free path in the theory of neutron transport. Calculations are restricted to media with plane symmetry, and monoenergetic neutron theory is employed. It is found that a neutron-flux based theory and a collision-density based theory can lead to significantly different results when low-order approximations, such as diffusion theory, are employed in the solution of the transport equation. For the case of isotropic scattering, the normal mode technique is found applicable and closed-form exact solutions are determined. There is little existing experimental work in the description of neutron distribution in such anisotropic media. It is therefore difficult to evaluate the results of the theory. The interpretation of physical and numerical (Monte Carlo) experiments could be approached directly with these techniques. (auth)

29172 (LADC-6488) NEUTRON PENETRATION FACTORS OBTAINED BY USING ADJOINT TRANSPORT CAL-

CULATIONS. G. E. Hansen and H. A. Sandmeier (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [nd]. Contract [W-7405-eng-36]. 15p. Dep.(mn); $1.00 (cy), 1(mn) CFSTI.

Adjoint transport theory is most widely used in perturbation theory. There is, however, a class of problems of the source-detector type where adjoint transport theory proves to be a very effective and fast way of obtaining the desired results. The theory is derived and subsequently applied to the two following problems. (a) The fissions induced in a spherical assembly containing fissionable material surrounded by a moderator due to an incident collimated neutron beam. (b) A neutron dose rate detection device consisting of a lithium iodide crystal to register absorptions surrounded by a sphere of polyethylene. (auth)

29173 (NAA-SR-Memo-10853) ANALYSIS OF NEUTRON TRANSMISSION THROUGH SLABS OF LITHIUM HYDRIDE. R. S. Hubner (Atomics International, Canoga Park, Calif.). Jan. 4, 1965. Contract [AT(11-1)-Gen-8]. 21p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

The results of the analyses of the ORNL Tower Shielding experiments of fast neutron transmission through lithium hydride slabs are presented and compared to the experimental data. Satisfactory agreement in the scattered dose is noted in all cases with the maximum deviation at the 30 inch thickness being only 25%. The calculated transmitted spectra and n^{th} collision doses are presented. The Monte Carlo techniques used in the analysis were described in NAA-SR-9418; modifications to these methods are presented. (auth)

29174 (ORNL-P-1116) NEUTRON CROSS SECTION MEASUREMENTS USING PULSED SOURCES. J. A. Harvey (Oak Ridge National Lab., Tenn.). [1965]. Contract [W-7405-eng-26]. 21p. (CONF-650217-1). Dep. (mn); $1.00(cy), 1(mn) CFSTI.

From Symposium on Pulsed High Intensity Fission Neutron Sources, Washington, D. C.

Some of the parameters which determine the value of a pulsed neutron source for low energy neutron spectroscopy in the energy range from 1 to 10^5 ev are outlined in order to compare a spectrometer consisting of a pulsed reactor with a chopper to a spectrometer consisting of a pulsed accelerator with a pulsed multiplier. (L.B.S.)

29175 (P-1496(RAND)) INVARIANT IMBEDDING AND NEUTRON TRANSPORT THEORY. IV. GENERALIZED TRANSPORT THEORY. Richard Bellman, Robert Kalaba, and G. Milton Wing (RAND Corp., Santa Monica, Calif.). Sept. 24, 1958. 16p. (AD-606998). $1.00(CFSTI).

Previous results and techniques are extended to include an extensive category of transport processes involving deterministic and stochastic interactions and general geometries. Characteristic functions and probabilities as well as expected values (fluxes) are determined. (auth)

29176 (PAN-539/IX) THE APPLICATION OF THE FAST CHOPPER AS A PULSE NEUTRON SOURCE FOR NEUTRON DIFFUSION PARAMETER MEASUREMENTS. Zb. Ogrzewalski and T. Rzeszot (Jolish Academy of Sciences, Warsaw. Inst. of Nuclear Research). Nov. 1964. 9p. Dep.

The fast chopper, operating at the horizontal channel of the EWA reactor, is applied as a pulse neutron source for measuring the neutron diffusion parameters of moderators. The burst of neutrons is injected into a moderator and the decay constant of the asymptotic thermal neutron flux is measured. Some preliminary results for organic glass obtained by this method are presented. (auth)

29177 (RPI-328-29) SPATIALLY DEPENDENT ASYMPTOTIC SPECTRA MEASUREMENTS IN WATER AND POLYETHYLENE. E. R. Gaerttner, R. R. Fullwood, J. H. Menzel, and G. P. Toth (Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Nuclear Engineering and Science). [1964]. Contract AT(30-3)-328. 23p. (CONF-650504-2). Dep. (mn); $1.00(cy), 1(mn) CFSTI.

From IAEA Symposium on Pulsed Nuetron Methods, Karlsruhe, Germany.

An experimental technique has been developed to perform spatially dependent asymptotic spectra measurements without having to rely on subsidiary monitors for normalization of the data. The pulsed electron linac–phased neutron chopper technique for measuring asymptotic spectra has been combined with a sequentially cycled automatic reentrant hole changer which made it possible to obtain a set of eight spectra and a background measurement within only eight minutes and using only one detection system. With this technique, the effect of the diameter of a reentrant hole on the amplitude and the shape of the scalar flux has been investigated in water. Spatially dependent measurements were made in water and polyethylene slabs. The spatial variation of the Maxwellian fit temperatures of the scalar flux in water was obtained and is in agreement with theoretical results. Preliminary results of $\epsilon = 0.556 \pm 0.005$ cm and $\epsilon = 0.493 \pm 0.006$ cm for the extrapolation lengths of water and polyethylene, respectively, were obtained by fitting the scalar flux for fifty energy values ranging from about 0.006 to 0.15 ev to a cosin distribution in the region of space-energy separability and then fitting these extrapolation lengths in a least squares sense to a constant. (auth)

29178 (RPI-328-31) ANALYSIS OF PULSED NEUTRON EXPERIMENTS IN MODERATING ASSEMBLIES. P. B. Daitch, R. R. Lee, and R. L. Hobson (Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Nuclear Engineering and Science). [1965]. Contract AT(30-3)-328. 34p. (CONF-650413-3). Dep.(mn); $2.00(cy), 1(mn)

From Symposium on Neutron Dynamics and Control, Tucson, Ariz.

Some features of the present state of the analysis of pulsed neutron phenomena in moderating assemblies are discussed. Much of the analysis is based on the use of a discrete mesh or groups to represent the energy variable and the use of spherical harmonic approximations to represent the angles. Although this type of approach does not yield a continuum of eigenvalues it is justified on physical grounds and is sufficient to represent the situations studied. Illustrative examples of eigenvalues and eigenfunctions are presented for mass-1 free gas and beryllium over a large range of bucklings; both discrete and continuum eigenfunctions are illustrated. The major features of the real time eigenvalues as they vary with sinusoidal and hyperbolic bucklings are shown in a schematic map of the real λ vs. B^2 plane. The analysis is then used in order to discuss some of the major areas of time-dependent thermalization investigation. (auth)

29179 (RT/FIMA(64)-2) SOLUTIONS OF A TRANSPORT-TYPE EQUATION IN A FAST TRANSIENT. M. Motta (Comitato Nazionale per l'Energia Nucleare, Bologna (Italy). Centro di Calcolo). Oct. 1964. 19p. (CONF-469-5) Dep.(mn).

From Conference on Physics of Reactors, Milan, Nov.-Dec. 1963.

An initial value problem described by a first order partial differential equation with space and time as independent variables is considered. Particular solutions, corresponding to an initial spatial distribution, have a very small existence region when fast transients are involved, as in the case of prompt critical fast reactors. By means of Laplace transform, solutions outside that region are obtained, which take account of what has happened in time past in the inner of physical system. By means of an electrical analogy which assumes the existence region as a net quadrupole, telegraph equation–the corect P_1 approximation to the Boltzmann equation in reactor theory–is finally deduced. (auth)

29180 (WAPD-T-1756) RITZ DIFFERENCE EQUATIONS ON A TRIANGULATION. R. B. Kellogg (Bettis Atomic Power Lab., Pittsburgh, Pa.). Jan. 1965. Contract AT-11-1-GEN-14. 15p. (CONF-650501-5). Dep. (mn); $1.00(cy), 1(mn) CFSTI.

From the Application of Computing Methods to Reactor Problems, Argonne, Ill.

The one-group neutron diffusion equation $-(pu_x)_x - (pu_y)_y + qu = f$ in a region R with boundary condition

$u(x,y) = 0$, $(x,y) \epsilon \Gamma$ on the boundary Γ of R is considered. Two theorems are proved which give estimates for the error in the approximate solution of the diffusion equation obtained by a variational method. The method of weighted residuals (Bubnov-Galerkin method) is used, and triangulations of the region R are performed; the discretization error for the Ritz approximate solution of the diffusion equation is then estimated. (M.J.T.)

29181 (WAPD-TM-477) THE PDQ-5 AND PDQ-6 PROGRAMS FOR THE SOLUTION OF THE TWO-DIMENSIONAL NEUTRON DIFFUSION-DEPLETION PROBLEM. W. R. Cadwell, P. F. Buerger, and C. J. Pfeifer (Bettis Atomic Power Lab., Pittsburgh, Pa.). Jan. 1965. Contract AT(11-1)-Gen-14. 81p. Dep.(mn); $3.00(cy), 2(mn) CFSTI.

PDQ-5 and PDQ-6 are FORTRAN programs which solve the two-dimensional neutron diffusion-depletion problem with up to five lethargy groups. The geometry is rectangular or cylindrical in PDQ-5 and hexagonal in PDQ-6. Both programs provide for variable mesh spacing. Problems in excess of 50,000 mesh points have been run successfully. (auth)

29182 (WAPD-TM-494) MO564, A FORTRAN PROGRAM FOR SYMMETRIC AND ASYMMETRIC RESONANCE INTEGRALS. D. R. Harris and G. J. Peters (Bettis Atomic Power Lab., Pittsburgh, Pa.). Nov. 1964. Contract AT (11-1)-Gen-14. 13p. Dep.; $1.00(cy), 1(mn) CFSTI.

A description is given of the FORTRAN program, MO564, designed for use on the Philco-2000 computer. The program computes the infinite dilution resonance integral, and the sum for a group of resonances, when the cross section for each resonance is represented by a single level Breit-Wigner formula. The calculation is carried out in two approximations referred to as symmetric and asymmetric corresponding to non-inclusion or inclusion of a lower energy cutoff and the $E^{-\frac{1}{2}}$ factor in the single level formula. The ratio of asymmetric to symmetric resonance integrals is plotted for practical ranges of resonance parameters and energy cutoff. (auth)

29183 REFRACTIVE INDEX FOR NEUTRONS. Joseph J. Devaney (Los Alamos Scientific Lab., N. Mex.). Am. J. Phys., 33: 403-5(May 1965). (LA-DC-6625)

A simple derivation is presented for the quadratic index of refraction of scalar waves in a nonmagnetic medium. (auth)

29184 EXACT SOLUTIONS OF HALF-SPACE PROBLEMS BY MEANS OF CASE'S METHOD. K.-D. Leuthaeuser (Universitat, Kiel). Atomkernenergie, 10: 97-106 (Mar.-Apr. 1965). (In German)

Case's method for finding exact solutions to the one-dimensional monoenergetic Boltzmann equation applied to half-space problems generally led to singular integral equations, the theory of which is briefly developed. Exact solutions of the source-free Milne problem was found in two different ways, the first leading to a homogeneous Hilbert-problem, and the second to an inhomogeneous Hilbert-problem. The result was identical to the result found by the Wiener-Hopf technique. Subsequently, explicit solutions to the Milne problem were obtained with different source distributions, first by expanding the flux directly in terms of the system of eigenfunctions, second by using the Green's function of the half-space. Both methods yielded different representations of the same flux. Hence some identities for the standard function X(v) were deduced, which can be used for computing the flux at the boundary. All the results can be generalized to the case of adjacent half-spaces of two different media. (auth)

29185 TWO-PHASE HYDROGEN DENSITY MEASUREMENTS BY NEUTRON ATTENUATION. Donald F. Shook (Lewis Research Center, Cleveland). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 112-16(Feb. 1965).

A desirable characteristic of a two-phase hydrogen density measurement by neutron attenuation is its ability to respond dynamically to a transient flow situation. Thickness measurements of a polyethylene mockup of liquid hydrogen indicate that with the use of intense compact Po–Be neutron sources in conjunction with an optimum moderator beam source arrangement, good dynamic measurements can be made. The equipment can be mobile and flexible and is adaptable for measuring the full range of hydrogen mixtures from liquid to gas in pipes up to 2 inches in diameter. (auth)

29186 THE LEAD ACTIVATION TECHNIQUE FOR HIGH ENERGY NEUTRON MEASUREMENT. C. E. Spencer and E. L. Jacobs (Sandia Corp., Albuquerque, N. Mex.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 407-14(Feb. 1965).

The yield of 14-Mev pulsed neutron sources may be measured by a detector which counts gamma decay from $^{208}Pb(n,2n)^{207m}Pb$ and $^{207}Pb(n,n')^{207m}Pb$ reactions. The threshold for the device is 1.6 Mev, and the half life of the ^{207m}Pb isomer is 0.8 sec. The high sensitivity and the short half life of a lead counter allow the detector to be operated in place and at frequent intervals. (auth)

29187 MONTE CARLO ANALYSIS OF NEUTRON-COLLIMATOR EFFICIENCY. William B. Green and Robert S. Hubner (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 8: 65-6(May 1965).

29188 EVALUATION OF NEUTRON SPATIAL DISTRIBUTIONS FROM THE PM-3A SECONDARY NEUTRON SOURCES. T. L. Boennighausen (Naval Nuclear Power Unit, Fort Belvoir, Va.). Trans. Am. Nucl. Soc., 8: 81-2 (May 1965).

29189 A NEW APPROACH TO STOCHASTIC NEUTRON TRANSPORT. H. E. Hungerford (Purdue Univ., Lafayette, Ind.). Trans. Am. Nucl. Soc., 8: 187-8(May 1965).

29190 COMPARISON OF NEUTRON-ATTENUATION CALCULATIONS USING MONTE CARLO, TRANSPORT AND DIFFUSION-THEORY METHODS. J. R. Tomonto, A. H. Kazi, J. Pirro, Jr., and S. S. Rosen (United Nuclear Corp., Chappaqua, N. Y.). Trans. Am. Nucl. Soc., 8: 188-9(May 1965).

29191 A METHOD OF CALCULATING FLUX SPECTRA AND NEUTRON ABSORPTIONS AT EPITHERMAL ENERGIES. F. E. Driggers (E. I. du Pont de Nemours and Co., Aiken, S. C.). Trans. Am. Nucl. Soc., 8: 206 (May 1965).

29192 THERMAL-NEUTRON ELASTIC AND INELASTIC SCATTERING. D. E. Parks (General Atomic, San Diego, Calif.). Trans. Am. Nucl. Soc., 8: 219(May 1965).

29193 SEVEN-POINT DIFFERENCE EQUATIONS WITH ARBITRARILY MESH SPACING FOR NEUTRON DIFFUSION IN 60° GEOMETRY BY THE INTEGRATION TECHNIQUE. R. C. Gast (Westinghouse Electric Corp., West Mifflin, Pa.). Trans. Am. Nucl. Soc., 8: 226-7 (May 1965).

29194 A USEFUL APPROXIMATION FOR THE SPATIAL AND ENERGY DEPENDENCE OF THE SCALAR FLUX IN HETEROGENEOUS MEDIA. Henri Fenech (Massachusetts Inst. of Tech., Cambridge), A. J. Goodjohn, and A. D. McWhirter. Trans. Am. Nucl. Soc., 8:227-8 (May 1965).

29195 A VARIATIONAL APPROACH TO THE EFFECT OF BOUNDARY PERTURBATIONS WHEN THE MULTIGROUP DIFFUSION EQUATIONS APPLY. N. Spinks (Australian Atomic Energy Commission, Sutherland, New South Wales). Trans. Am. Nucl. Soc., 8: 229-30(May 1965).

29196 ESCAPE PROBABILITIES BY A GENERALIZED INVARIANT IMBEDDING KERNEL. J. O. Mingle (Kansas State Univ., Manhattan). Trans. Am. Nucl. Soc., 8: 230-1 (May 1965).

29197 IMPROVED P_3 VACUUM BOUNDARY CONDITIONS AND THEIR USE IN PULSE CALCULATIONS. E. M. Gelbard and E. Schmidt (Westinghouse Electric Corp., West Mifflin, Pa.). Trans. Am. Nucl. Soc., 8: 231(May 1965).

29198 A MATHEMATICAL VERFICATION OF MARSHAK'S HEURISTIC BOUNDARY CONDITIONS. B. D. O'Reilly (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 8: 231-2(May 1965).

29199 FAST-SPECTRUM DOPPLER MEASUREMENTS. T. H. Springer, S. G. Carpenter, L. A. Mountford, and R. J. Tuttle (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 8: 242(May 1965).

29200 EVALUATION OF GROUP CROSS SECTIONS FOR LIGHT REFLECTORS OF FAST REACTORS. David Meneghetti (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 247-8(May 1965).

29201 SPATIAL DISTRIBUTIONS IN WATER OF NEUTRONS FROM A 2.85 Mev T(p,n)He^3 SOURCE. R. W. Stooksberry and E. E. Carroll, Jr. (Westinghouse Electric Corp., West Mifflin, Pa.). Trans. Am. Nucl. Soc. 8: 251-2 (May 1965).

29202 MEASUREMENTS AND CALCULATIONS OF FAST-NEUTRON ATTENUATION AND THERMALIZATION IN H_2O. Martin O. Cohen, Herbert Goldstein, and Leon J. Kidofsky (Columbia Univ., New York). Trans. Am. Nucl. Soc., 8: 252(May 1965).

29203 AGE OF PLUTONIUM–BERYLLIUM NEUTRONS TUNGSTEN–WATER MEDIA. Donald Shook and Roger L. Alexander (Lewis Research Center, Cleveland). Trans. Am. Nucl. Soc., 8: 252-3(May 1965).

29204 APPLICATION OF MOORE'S METHOD TO THE ANALYSIS OF THERMAL-NEUTRON PULSE-PROPAGATION EXPERIMENTS. R. S. Booth, R. H. Hartley, and R. B. Perez (Univ. of Florida, Gainesville). Trans. Am. Nucl. Soc., 8: 272(May 1965).

29205 AN ANALYSIS OF THE ERRORS ASSOCIATED WITH THE DETERMINATION OF SPATIAL HARMONICS. J. R. Wolberg (Technion–Israel Inst. of Tech., Haifa). Trans. Am. Nucl. Soc., 8: 273-4(May 1965).

29206 THE APPLICATION OF TWO VARIATIONAL TECHNIQUES TO THE ANALYSIS OF THE PULSED-NEUTRON EXPERIMENT. Robert B. Rasminas, G. R. Dalton, and M. J. Ohanian (Univ. of Florida, Gainesville). Trans. Am. Nucl. Soc., 8: 274(May 1965).

29207 PULSED-SOURCE MEASUREMENTS OF NEUTRON-DIFFUSION PARAMETERS IN WATER. E. Gon, L. Lidofsky, and H. Goldstein (Columbia Univ., New York). Trans. Am. Nucl. Soc., 8: 274-5(May 1965).

29208 MEASUREMENT AND ANALYSIS OF TIME-DEPENDENT NEUTRON SPECTRA IN D_2O. R. C. Kryter, G. P. Calame, R. R. Fullwood, and E. R. Gaerttner (Rensselaer Polytechnic Inst., Troy, N. Y.). Trans. Am. Nucl. Soc., 8: 276-7(May 1965).

29209 PULSED-NEUTRON MEASUREMENTS IN INFINITE MEDIA. K. L. Garlid (Univ. of Washington, Seattle) and S. R. Bierman. Trans. Am. Nucl. Soc., 8: 277-8(May 1965).

29210 EXPERIMENTAL DETERMINATION OF THE GEOMETRIC BUCKLING OF IRREGULARLY SHAPED BODIES. K. L. Garlid and D. D. Panetti (Univ. of Washington, Seattle). Trans. Am. Nucl. Soc., 8: 281-2(May 1965).

29211 P_1 SPACE-ENERGY DEPENDENT THEORY OF NEUTRON-WAVE PROPAGATION. H. H. Kunaish, R. B. Perez, and R. S. Booth (Univ. of Florida, Gainesville). Trans. Am. Nucl. Soc., 8: 291-1(May 1965).

29212 ASYMPTOTIC DECAY CONSTANTS IN SMALL SLABS AND CUBES BY SPATIAL-EXPANSION METHOD. N. C. Paik, A. Travelli, and I. Kaplan (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nucl. Soc., 8: 292-3(May 1965).

29213 NEUTRON-WAVE PARAMETERS IN MONOENERGETIC TRANSPORT THEORY. A. Travelli (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nucl. Soc., 8: 293-4(May 1965).

29214 ANGULAR MOMENTS IN INTEGRAL TRANSPORT EQUATION. Adnan A. Aswad and G. R. Dalton (Univ. of Florida, Gainesville). Trans. Am. Nucl. Soc., 8: 294-5(May 1965).

29215 FIRST-ORDER SOLUTIONS OF THE ONE-SPEED TRANSPORT EQUATION IN PLANE MULTI-REGION GEOMETRIES. M. R. Mendelson (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Am. Nucl. Soc., 8:296-7(May 1965).

29216 SCATTERING OF LOW-ENERGY NEUTRONS FROM WATER. J. R. Beyster, J. M. Neill, and J. C. Young (General Atomic, San Diego, Calif.). Trans. Am. Nucl. Soc., 8: 298(May 1965).

29217 THE EFFECTS OF COHERENT SCATTERING ON THE THERMALIZATION OF NEUTRONS IN BERYLLIUM. R. R. Fullwood, E. R. Gaerttner, and R. E. Slovacek (Rensselaer Polytechnic Inst., Troy, N. Y.). Trans. Am. Nucl. Soc., 8: 298-9(May 1965).

29218 NEUTRON-SPECTRUM MEASUREMENTS ACROSS A POLYETHYLENE CELL. J. M. Neill and J. C. Young (General Atomic, San Diego, Calif.). Trans. Am. Nucl. Soc., 8: 299-300(May 1965).

29219 PROCEDURES FOR OBTAINING FEW-GROUP CONSTANTS FOR SYSTEMS HAVING RAPID SPECTRAL VARIATION WITH POSITION. J. M. Ravets and L. I. Kopp(Westinghouse Astronuclear Lab., Pittsburgh). Trans. Am. Nucl. Soc., 8: 303-4(May 1965).

29220 AN INVESTIGATION OF MAGNETIC SMALL-ANGLE SCATTERING OF SLOW NEUTRONS ON DISLOCATIONS IN NICKEL. Adolf Stork (Technischen Hochschule, Munich), Josef Christ, and Werner Schmatz. Z. Angew. Phys., 18: 468-71(Apr. 1965). (In German)

The magnetization near dislocations is inhomogeneous by a mechanism of magnet elastic coupling. As Kronmüller, Seeger, and Wilkens showed this effect causes small-angle scattering, which is appreciably larger than the scattering of non-magnetic materials. Small-angle scattering was measured as a function of magnetic field and scattering angle on cold-worked nickel. The intensity gave the dislocation density and measurements with different fields and scattering angles allowed calculation of mean dislocation distance. (auth)

29221 PORTATIVNYE GENERATORY NEITRONOV V YADERNOI GEOFIZIKE. (Portable Neutron Generators in Nuclear Geophysics). S. I. Savosina, ed. Moscow, Gosatomizdat, 1962. 204p.

Twenty articles are included on the design, construction and applications of neutron generators. The theory of neutron-neutron logging and practical use of generators in developing oil deposits in U.S.S.R. are also discussed. Descriptions are given of various types of neutron generating acceleration tubes, portable well instrumentation, and neutron generators producing short-lived isotopes for activation analysis in reactor construction, biology, mining and other fields. (R.V.J.)

29222 NEUTRON GENERATION. Charles W. Tittle (to Laboratory for Electronics, Inc.). U. S. Patent 3,146,366. Aug. 25, 1964. Filed Oct. 5, 1959.

A specific mixture of deuterium and tritium gas provides a constant neutron output level when used as an ion source in a neutron generator tube in conjunction with a deuterium target. The mixture contains tritium and deuterium in the proportions $\underline{f}$ and $1-\underline{f}$ where $\underline{f}$ is determined by the formula $\underline{f} = r/(1+r)$ in which $\underline{r}$ is the ratio of neutron yield of the deuterium on tritium reaction to the yield of the tritium on deuterium reaction. The buildup of tritium on the target and the resulting increase of deuterium on tritium reactions during neutron-producing collisions balances out loss of neutrons due to tritium on tritium collisions. (A.G.W.)

29223 ION ACCELERATION PULSED NEUTRON GENERATOR. Joseph V. Braddock, Bernard J. Dunn, Daniel F. McDonald, Henry A. Miranda, Jr., and Thomas G. Bullen. U. S. Patent 3,173,013. Mar. 9, 1965. Filed Dec. 20, 1961.

In the neutron generator described, a deuterium or tritium gas is introduced into one portion of a continuously, but not highly, evacuated tube and the molecules are subjected to a high-voltage field between a pair of spaced, electrically energized electrodes within the tube. Ions of the gas are thus generated and accelerated from adjacent one of the electrodes toward the other electrode, which has a target surface containing deuterons or tritons required for the production of neutrons. Pulses of 4×10^9 neutrons were produced consistently, and higher peak yields were obtained. (A.G.W.)

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Refer also to abstracts 28364, 28365, 28446, 28641, 28717, 28962, 29093, 29174, 29468, 29475, and 29518.

29224 (AE-181) STUDIES OF THE FISSION INTEGRALS OF U235 AND Pu239 WITH CADMIUM AND BORON FILTERS. E. Hellstrand (Aktiebolaget Atomenergi, Stockholm (Sweden)). Apr. 1965. 32p. Dep.(mn).

The resonance fissions in ^{235}U and ^{239}Pu were studied using cadmium and boron filters. Fission chambers were used as detectors and the experiments were performed in beam geometry. The neutron energy distribution in the beams transmitted through the different filters was determined with a fast chopper. From the cadmium filter measurements the fission resonance integrals were determined. The values obtained were 278 ± 9 b for ^{235}U and 301 ± 10 b for ^{239}Pu; 0.5 ev < E < 1 Mev. Complementary ^{239}Pu measurements were made in which the fission events were detected from the fission product activity in irradiated foils, and the value of the ^{239}Pu resonance integral agreed well with that obtained from the fission chamber measurement. The experiments with the boron filters yieided results which, for the thin filter, agreed well with those calculated from the cross section data given in the Karlsruhe compilation. The discrepancy was larger for the thick filter but the values did not disagree outside the common limits of error. (auth)

29225 (AECD/CH/2) ELEMENTS OF RADIOACTIVE GROWTH AND DECAY. Abdur Rahman (Atomic Energy Centre, Dacca (Pakistan). Chemistry Div.). Jan. 1965. 46p. Dep.(mn).

The equations and procedures involved in computations of radioactive growth and decay rates are developed from elementary principles, using no mathematics beyond the intermediate level. Discussions are given of the basic rate equation, counting and disintegration rates, half life, average life, branching decay, mixtures of simple activities, chain disintegration, and radioactive equilibrium—secular, transient, and nonequilibrium states. (M.J.T.)

29226 (AECD/EP/2) A REVIEW OF ELASTIC AND INELASTIC SCATTERING OF PROTONS OF ENERGY UP TO 3 Mev BY LIGHT NUCLEI (A = 4 TO 22). Khalida Begum (Atomic Energy Centre, Dacca (Pakistan). Experimental Physics Div.). Sept. 1964. 43p. Dep.(mn).

Various models developed previously for intranuclear forces and for proton reactions with nuclei are reviewed briefly. References are given to 55 experimental studies on proton elastic and inelastic scattering from light nuclei, and abstracts are presented for each reference. (M.J.T.)

29227 (AEET/ANAL/32) A CHART OF GAMMA ENERGIES VS. HALF-LIFE FOR NUCLIDES PRODUCED BY (n,γ) AND (x-x′) REACTIONS. S. Gangadharan, R. Krishnamoorthy Iyer, and M. Sankar Das (Atomic Energy Establishment, Trombay (India). Analytical Div.). 1964. 9p. Dep.(mn).

In activation analysis the use of gamma-ray spectrometry facilitates the identification of a given nuclide from the observed half life and energy of the gamma ray. For the identification of a nuclide as well as the evaluation of interferences from other nuclides a plot of the gamma ray energies against half life is very useful. This form of plot is presented in the three graphs covering the energy ranges 0-300 kev, 300-800 kev, and 800 kev-3 Mev and for the half-life range of 1 sec. to 5 years for nuclides produced by (n,γ) and (x-x′) reactions. To have a quantitative idea, the photopeak activity of the characteristic gamma rays of the nuclide is given as an index. The activity produced by the irradiation of 1 μg of element to saturation at a flux of 10^{12} neutrons cm^{-2} sec^{-1} was used for calculating the index. (auth)

29228 (AEET/NP/10) PROGRESS REPORT ON NUCLEAR DATA MEASURING ACTIVITIES IN INDIA-1. (Atomic Energy Establishment, Trombay (India)). 1964. 27p. Dep.(mn).

Nuclear data measurements by groups in India are summarized. (J.R.D.)

29229 (BNL-918) LEAST SQUARES ANALYSIS OF THE 2200 M/SEC PARAMETERS OF U^{233}, U^{235}, AND Pu^{239}. Final Report. Rudolph Sher and Joan Felberbaum (Brookhaven National Lab., Upton, N. Y.). Mar. 1965. Contract [AT(30-2)-Gen-16]. 11p. (EANDC(US)-75(U)). Dep.; $1.00(cy), 1(mn) CFSTI.

A revision is made of the 1962 values of the 2200 m/s cross sections of the fissionable isotopes ^{233}U, ^{235}U, and ^{239}Pu in which new data are included, some old data revised or eliminated, and errors rectified. The total number of measurements used increased from 60 to 82. All data in the BNL Sigma Center files in December were considered; most have been included, the exceptions being some results which were superseded by later data from the same authors. (L.B.S.)

29230 (CEA-R-2730) QUELQUES CONSIDERATIONS SUR LE SPECTRE D'ENERGIE DES NOYAUX IMPAIR-IMPAIR DEFORMES. (Some Considerations of the Energy Spectrum of Odd-Odd Deformed Nuclei). Alceanu G. De Pinho and Jean Picard (Commissariat à l'Énergie Atomique, Saclay (France). Centre d'Études Nucléaires). Feb. 1965. 56p. Dep.(mn).

The odd-odd deformed nuclei are described as a rotator plus two odd nucleons moving in orbitals Ω_p and Ω_n of the deformed potential. The energies and wave functions of the various states of the (Ω_p, Ω_n) configurations are investigated by calculating and numerically diagonalizing the hamiltonian matrix (with R.P.C. and residual interactions). The Gallagher-Mosskowski coupling rules and the abnormal K = 0 rotational bands are discussed. (auth)

29231 (CERN-65-6) A FORTRAN PROGRAMME FOR THE ANALYSIS OF HYPERFRAGMENTS AND FOR OTHER EMULSION STUDIES. A. G. Frodesen, K. S. Koelbig, and M. M. Nikolic (European Organization for Nuclear Research, Geneva (Switzerland)). Feb. 8, 1965. 75p. Dep.(mn).

The program, in CERN FORTRAN and tested on IBM 7090, is primarily designed as an aid for identification of hyperfragments from kinematical analysis of the production and/or decay vertices. The program considers the kinematics for capture at rest of a negative meson or baryon by the light emulsion nuclei ^{12}C, ^{14}N, and ^{16}O, and for decay at rest or in flight of a hyperfragment. The subroutines of the program are described, and the calculation procedure is presented in terms of separate flow charts for each of them. An explanation of the input and some examples are given. The output is also presented for these examples. (M.J.T.)

29232 (CONF-758-2) TOTAL CROSS SECTION MEASUREMENTS OF STABLE AND RADIOACTIVE ISOTOPES. G. D. Hickman (Knolls Atomic Power Lab., Schenectady, N. Y.). Jan. 12, 1965. Contract W-31-109-eng-52. 18p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From American Physical Society Meeting, New York, Jan. 1965.

A program is outlined to measure energy dependent thermal total cross sections (0.01 to 10 ev) of stable and radioactive isotopes. The design of the slow neutron chopper-flight path system with energy resolution of 3 to 5% used in the measurements is described. Results of measurements on ^{141}Pr and ^{133}Cs are given, and preparations for cross-section measurements on ^{147}Pm and ^{147m}Pm are described. (M.J.T.)

29233 (CONF-650410-1) COMBINED R-FUNCTION AND OPTICAL POTENTIAL FITTING FORMULA FOR FAST NEUTRON CROSS SECTIONS. E. Leo Slaggie (Knolls Atomic Power Lab., Schenectady, N. Y.). [1964]. Contract W-31-109-eng-52. 9p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From American Physical Society, Washington, D. C.

Satisfactory fits to data on neutron scattering by ^{12}C and ^{16}O were obtained using a resonance formula based on R-matrix theory, with the potential scattering calculated from an optical potential. Expressions are developed for the total cross section in terms of phase shifts, and for the phase shift and the R-function. A real Saxon-well optical potential with a Thomas spin-orbit term was chosen to give D-$^3/_2$ single-particle resonances. Compound-nucleus resonances were included by selecting resonance energies and reduced nuclear widths of the correct magnitude, spin, and partly to agree with elastic cross section and angular distribution data. Calculations were performed with the program OPTIC. Examples are given of fits to ^{12}C neutron cross sections and elastic angular distributions at energies from 2.8 to 5.0 Mev, and to ^{16}O angular distributions at 0.995 Mev. (M.J.T.)

29234 (COO-1195-8) SEARCH FOR ANOMALOUS PHOTOPION PRODUCTION FROM HELIUM. L. Criegee, G. Moscati, B. M. K. Nefkens, and J. H. Smith (Illinois Univ., Urbana). [1964]. Contract [AT(11-1)-1195]. 11p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

An experiment on the photoproduction of charged pions from ^4He is reported, indicating that π^+ and π^- photoproduction, proceeds through similar nuclear mechanisms, in the reactions (1) $\gamma + {}^4He \rightarrow \pi^+ + {}^3H + n$ and (2) $\gamma + {}^4He \rightarrow \pi^- + {}^3He + p$. A cylinder of liquid He was irradiated with a 300-Mev betatron bremsstrahlung beam, and photopions were counted by a plastic scintillator telescope consisting of two dE/dx counters and a stopping scintillator. Yields of 116.3-Mev/c π^+ mesons from H at 30° and of 117.2-Mev/c π^- and 116.0-Mev/c π^+ mesons from He at 30, 80, and 120° were measured as functions of peak bremsstrahlung energy. The effect of a possible strong ^4H state, intermediate in reaction (1) on the π^-/π^+ ratio is calculated, taking into account the Coulomb interactions in the final states of the reactions; a large admixture of ^4H is found to be inconsistent with the data. (M.J.T.)

29235 (GA-5905) NEUTRON CROSS SECTIONS FOR BERYLLIUM. G. D. Joanou and C. A. Stevens (General Atomic, San Diego, Calif.). Nov. 13, 1964. Contract SNPC-27. 33p. (NASA-CR-54262; N65-16202). $2.00 (CFSTI).

A revised set of neutron cross sections was prepared for beryllium. The data are based upon existing experimental data when possible. The compiled and evaluated data are incorporated into the GAM-II slowing-down program and into the GATHER-II thermalization program. A discussion is given of the possible reactions along with tables of the cross sections, the lattice vibrational spectrum for the thermal energy region, and Legendre expansion coefficient for beryllium. (L.B.S.)

29236 (GA-6136) IONIZATION ENERGY DEPOSITION FROM 14-Mev NEUTRON BOMBARDMENT OF SILICON AND GERMANIUM. D. K. Nichols (General Atomic, San Diego, Calif.). Feb. 10, 1965. Contract DA-49-186-AMC-65(X). 6p.

Bombardment of silicon and germanium with 14-Mev neutrons creates energetic recoil atoms and light charged particles which lose some or all of their energy in ionizing collisions. An estimate of the amount of energy deposited in ionizing processes and the rate of formation of electron-hole pairs are calculated from recent experimental data. (L.B.S.)

29237 (IDO-17073) TERNARY FISSION OF ^{235}U INDUCED BY NEUTRONS OF ENERGY BELOW 1 eV. L. G. Miller and M. S. Moore (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.). Mar. 1965. Contract AT(10-1)-205. 12p. Dep.; $1.00(cy), 1(mn) CFSTI.

The neutron energy dependence of the relative ternary-to-binary fission yield for ^{235}U was measured for neutron energies between 0.025 and 1 ev. The data show that the variation in the relative ternary fission yield is less than 1.6% in this energy region. (auth)

29238 (INP-361) SPIN POLARIZATION EFFECT AND THE MAGNETIC MOMENTS OF ODD-A DEFORMED NUCLEI. Z. Bochnacki and S. Ogaza (Institute of Nuclear Physics, Krakow (Poland)). Nov. 1964. 16p. Dep.

The effect of the spin polarization of the even-even core on magnetic moments of odd-A deformed nuclei is discussed. Comparison of the measured and calculated values of the effective spin g-factor shows that the spin polarization explains quite well the observed reduction of g_s from its free-nucleon value. (auth)

29239 (INP-362) WŁASNOSCI MAGNETYCZNE SILNIE ZDEFORMOWANYCH JADER ATOMOWYCH. (Magnetic Properties of Strongly Deformed Nuclei). Stanisław Ogaza (Institute of Nuclear Physics, Krakow (Poland)). 1964. 54p. Dep.

An analysis of all the available experimental data on magnetic properties of deformed nuclei in the region $150 < A < 190$ is performed. It appears that with pairing correlations included, the theoretical rotational g-factors are in good agreement with the experimental g_R-values, especially for even-even nuclei. Taking into account for odd-A nuclei, the spin polarization of the even-even core by the odd particle, a satisfactory agreement of experimental and theoretical values for the intrinsic g-factors, g_K, is obtained. (auth)

29240 (INP-402/PL) RAPID IDENTIFICATION OF ISOBARS BY THE LARGE-ANGLE SCATTERING OF LOW-ENERGY ALPHA PARTICLES FROM THE CYCLOTRON. A. Z. Hrynkiewicz, H. Niewodniczanski, and L. Pomorski (Institute of Nuclear Physics, Krakow (Poland)). Jan. 1965. 14p. Dep.

The 5-Mev α-particle beam from the cyclotron was used for the identification of isobars by the energy determination of the back-scattered particles. In comparison with the method on the use of natural α-sources, the measurement time is much shorter. Preliminary results are reported as an example of the possibilities of the application of this method. (auth)

29241 (INP-403/PL) ENERGY DEPENDENCE OF THE ELASTIC SCATTERING OF ALPHA PARTICLES ON ^{40}Ca NUCLEI UP TO 179°. A. Budzanowski, K. Grotowski, L. Jarczyk, B. Lazarska, S. Micek, H. Niewodniczanski, A. Strzalkowski, and Z. Wrobel (Institute of Nuclear Physics, Krakow (Poland)). Mar. 1965. 22p. Dep.

Differential cross sections for elastic scattering of alpha particles on ^{40}Ca nuclei were measured at alpha-particle energies 23.37, 24.15, 24.7, 25.23, 26.37, and 28.92 Mev. Measurements were performed in the angular range from 22.5 up to 179° in cm system. For all these energies, an appreciable increase of the cross section for extreme back angles was observed. A broad resonance at the energy of alpha particles of about 24 Mev was found for both the integrated cross section as well as for the differential cross section at 179°. (auth)

29242 (JINR-E-2012) EXCITATION FUNCTIONS AND ISOMERIC YIELD RATIOS FOR THE REACTION $C^{12}(N^{14},2p)Na^{24m,g}$. K. F. Alexander, H. F. Brinckmann, G. Lang, and H. Rotter (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1965. 10p. Dep.(mn).

Absolute cross sections for the reaction $^{12}C(^{14}N,2p)^{24}Na$ leading to the 20-msec isomeric state and the 15-hr ground state of ^{24}Na were measured, using a pulsed external ion beam from the cyclotron U-150. Bombarding energies varied between 20 and 65 Mev. The isomeric yield ratio shows a pronounced maximum at about 35 Mev bombarding energy. Possible interpretations of this behavior are discussed. (auth)

29243 (JINR-E-2047) SOLUTION OF THE BETHE-GOLDSTONE EQUATION FOR THE REACTION MATRIX IN FINITE NUCLEI. J. Blank and I. Ulehla (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1965. 31p. Dep.(mn).

A method for solving the equation for the t-matrix in doubly magic nuclei is presented. The internucleon potential contains a hard core, and the model single-particle potential has a harmonic oscillator form. The exclusion principle is taken exactly into account. The solution is found in a simplified one-dimensional case, the attractive part of the internucleon potential being of the Yukawa type. (auth)

29244 (JINR-P-1973) KOLLEKTIVNYE NEROTATSIONNYE SOSTOYANIYA DEFORMIROVANNYKH CHETNO-CHETNYKH YADER. (Collective Nonrotational States of Deformed Even-Even Nuclei). V. G. Solov'ev (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1965. 96p. Dep.(mn).

A microscopic description of the collective nonrotational excited states of even-even deformed nuclei is presented on the basis of the superfluid nuclear model in the framework of the approximate second method. The experimental data on the energies of quadrupole and octupole states and on the reduced probabilities of L, β, and γ transitions are classified. The structure of quadrupole and octupole states is investigated. It is shown that the calculations by the superfluid nuclear model are in good agreement with experimental data. (auth)

29245 (JINR-P-2014) POPYTKA OPREDELENIYA CHETNOSTI OSNOVNOGO SOSTOYENIYA Pu^{239}. (An Attempt of Determining the Parity of the Ground State of Pu-239). Yu. A. Aleksandrov, Yu. V. Ryabov, and G. S. Samosvat (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1965. 9p. Dep.(mn).

The results of measurements of the gamma ray spectra produced in the capture of neutrons in the resonances of ^{239}Pu with spin 0 and 1 in the energy range 0.3 to 24 ev are given. An attempt is made to determine the parity of the ground state of ^{239}Pu by comparing these spectra. (auth)

29246 (JINR-P-2019) PRAVILO SUMM DLYA MAGNITYKH MOMENTOV I ZATUKHANIE MAGNITIYKH MOMENTA NUKLONA V YADRE. (Sum Rule for the Magnetic Moments and the Quenching of the Nucleon Magnetic Moment in the Nucleus). S. B. Gerasimov (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1965. 8p. Dep.(mn).

The sum rule for magnetic moments which is a consequence of the unsubtracted dispersion relations and the low-energy theorem for the Compton scattering amplitude is used to estimate the quenching of the magnetic moment of a nucleon bound in the nucleus. It is shown that in the framework of the Fermi-gas model for the nucleus the effect of the exclusion principle leads to a decrease by about 7-8% of the anomalous magnetic moment of a bound nucleon as compared to a free one. Other possible applications of the obtained sum rule are discussed. (auth)

29247 (JINR-P-2024) VZAIMODEISTVIE NEITRONOV S YADRAMI URANA-235 V OBLASTI ENERGII 0.002-30 Kev. (Reactions of Neutrons with Uranium-235 Nuclei at 0.002 to 30 kev). Thih-ti Wang, Yung-chang Wang, E. Dermendzhiev, and Yu. V. Ryabov (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1965. 25p. (CONF-650301-35). Dep.(mn).

From Symposium on the Physics and Chemistry of Fission, Salzburg, Austria.

Level parameters, mean fission cross sections, and radiative capture in neutron reactions with ^{235}U nuclei at 0.002 to 3 kev were measured by a time-of-flight method using pulsed fast reactor as a resonance neutron source. A 2048-channel analyzer with channel width 32, 16, and 8 μsec was used for recording energy intervals at 0.002 to 0.005, 0.005 to 1.5, and 1.5 to 30 kev, respectively, resulting in a resolution of $\Delta t/L = 0.04$ μsec/m. (R.V.J.)

29248 (JINR-P-2045) O KOLLEKTIVNYKH NEROTATSIONNYKH SOSTOYAKH NECHETNYKH DEFORMIROVANNYKH YADER. (On Collective Nonrotational States of Odd-Mass Deformed Nuclei). V. G. Solov'ev (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1965. 8p. Dep.(mn)

The collective nonrotational states of odd-mass deformed nuclei are generally investigated. Some conclusions are drawn about the position of such states in the nuclei of rare-earth and transuranium regions. (auth)

29249 (JINR-P-2068) SILOVYE FUNKTSII URANA-235 DLYA NEITRONOV S l = 0 I 1. (Strength Functions of U-235 for Neutrons With l = 0 and 1). Yu. V. Ryabov and Yu. I. Fenin (Joint Inst. for Nuclear Research, Dubna, (USSR). Lab. of Neutron Physics). 1965. 5p. Dep.(mn).

The strength functions for S and P neutrons were calculated from an analysis of the average of the summed cross sections for fission and radiative capture. An electronic computer was used. The values for the strength functions were found to be $S_0 = (0.91 \pm 0.03) \times 10^{-4}$ and $S_1 = (2.8 \pm 0.4) \times 10^{-4}$. (auth)

29250 (KFK-296) ON ISOBARIC ANALOGUE STATES. Joachim Jaenecke (Kernforschungszentrum. Karlsruhe (West Germany). Institut fuer Experimentelle Kernphysik). Feb. 1965. 31p. Dep.(mn).

The excitation energies of isobaric analog states, i.e., the energetically lowest states with a given isobaric spin T, have been related to the symmetry and pairing energies of the respective nuclei. Symmetry parameters a(A) and pairing energies δ(A) were extracted from the experimental data. The parameter a(A) exhibits shell structure. An expression for the energetic difference between isobaric analog states was established which reproduces the over 200 known values (known experimentally or calculated from the known masses of neighboring isobars) up to A = 80 with a standard deviation of about 0.5 Mev. The same formula can be used to predict unknown excitation energies of isobaric analog states and the masses of unknown neutron-rich and proton-rich nuclei. The above expression is in accordance with a theoretical expression based on an effective two-nucleon interaction. There exist small but systematic deviations from the supermultiplet model. (auth)

29251 (LA-3267) GAMLEG—A FORTRAN CODE TO PRODUCE MULTIGROUP CROSS SECTIONS FOR PHOTON TRANSPORT CALCULATIONS. K. D. Lathrop (Los Alamos Scientific Lab., Univ. of California, N. Mex.). Mar. 11, 1965. Contract W-7405-eng-36. 32p. Dep.; $2.00(cy), 1(mn) CFSTI.

GAMLEG is a cross section code which prepares group averages of the Legendre moments of the Klein-Nishina differential scattering cross section. For the isotropic component the group scattering cross section is prepared and compared to the sum of the partial cross sections to insure consistency. The code also accepts as input, absorption, coherent scattering, source, and flux data (for up to 1000 pieces of information at up to 1000 energy points for each type of input), and provides group averages of this data. At the option of the user, cross sections can be flux weighted, source weighted, or unweighted. Up to 100 energy groups can be formed from group energy bounds supplied by the user. Group averages are performed by trapezoidal integration at up to 100 intervals in each group. As written, up to six Legendre component scattering matrices may be prepared for an arbitrary number of elements. Additional moments may be prepared with minor code modification. Cross section output is in a form suitable for input to the Los Alamos DTF and DDF transport codes. (auth)

29252 (LA-DC-6674) FISSION MASS YIELD STUDIES. B. P. Ford and R. B. Leachman (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1964]. Contract W-7405-eng-36. 18p. (CONF-650301-12). Dep.(mn); $1.00 (cy), 1(mn) CFSTI.

From Symposium on the Physics and Chemistry of Fission, Salzburg, Austria.

Data and an analysis method relevant to two significant deviations from the two-mode-of-fission hypothesis are considered. The data analysis method, consisting of removing the effect of the fission-chance split to obtain first-chance yields from measured yields is discussed; averages and standard deviations of excitation energy for second- and third-chance fission and probabilities for first-, second-, and third-chance fission, are given. The

test of the two-mode-of-fission hypothesis for observed and first-chance fission yields of the ^{236}U initial compound nucleus and for observed mass yields from neutron-induced fission of ^{232}Th and ^{238}U is considered, and test results are discussed. (M.J.T.)

29253 (LA-DC-6675) PROMPT NEUTRONS FROM FISSION. James Terrell (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1964]. Contract W-7405-eng-36. 30p. (CONF-650301-13). Dep.(mn); $2.00(cy), 1(mn) CFSTI.

From Symposium on the Physics and Chemistry of Fission, Salzburg, Austria.

A survey is given of the present state of knowledge of the spectrum, angular distribution, and number of prompt fission neutrons, as functions of incident neutron energy and individual fragment mass, for low-energy fission. The energy spectrum of prompt neutrons has been found to be of the same form, nearly Maxwellian, for many different types of fission. It has been shown that this type of spectrum is to be expected on the basis of evaporation from moving fragments, and theoretical predictions of the spectrum agree very accurately with experimental data. Some data are now available on the variation of the neutron spectrum with fragment mass and angle of emission. Only recently has it become possible to take accurate data on the angular distribution of the neutrons. It appears that the neutrons have the angular distribution to be expected if emitted almost isotropically from the moving fragments, with a possibility that some small fraction are not emitted in this way, but directly from the fissioning nuclide. Much work has been done on the variation of fission neutron number $\bar{\nu}$ with incident neutron energy for neutron-induced fission. The neutron number increases roughly linearly with energy, with a slope of the order of 0.15 neutron/Mev. There is now evidence that this slope changes somewhat with energy. This change must be associated with other changes in the fission process. The most interesting recent discovery about fission neutrons is the strong dependence of neutron number on individual fragment mass. The data are being rapidly improved by means of the newer techniques of determining fragment mass yields from velocity and pulse height data, and of determining neutron yields from cumulative mass yields. There is evidence of similar dependence of neutron yield on fragment mass in a number of cases. It has been suggested that this property is directly connected with the deformability of the fragments, and in particular with the near-spherical shapes of magic-number fragments. On the basis of a simple fragment-deformation theory, the deformation parameter is calculated directly from experimental data, and is seen to have a very similar dependence on mass for four types of fission. These ideas seem likely to lead to a more basic understanding of the fission process, including the mass yields and energies of the fragments. (auth)

29254 (NEVIS-128 and Add.) MUON CAPTURE IN $(p\mu d)^+$ MOLECULES (thesis). I-Tung Wang (Nevis Labs., Columbia Univ., Irvington-on-Hudson, N. Y.). Jan. 1965. Contract Nonr-266(72). 99p. (R-473 and Add.; CU-234 and Add.; AD-613616)

The $(p\mu d)^+$ molecules and μ-^3He atoms formed in liquid hydrogen were used to detect neutrons from muon capture by deuterons and from muon capture by ^3He. A purified muon beam was stopped in a target containing ultra-pure liquid hydrogen with 0.32% deuterium added. Neutron-gamma ray discriminating detectors and oscilloscope photography were used to measure the time distribution of neutrons from the following rare muon capture processes: $\mu^- + d \rightarrow \nu + 2n$, $\mu^- + {}^3He \rightarrow \nu + n + d$, and $\mu^- + {}^3He \rightarrow \nu + 2n + p$. Knowledge of the time distributions of the various $(p\mu d)^+$ hyperfine states and of the μ-^3He atoms was used to obtain the various muon capture rates of interest. Converted to the μd atom case, the measured rate gives 388 ± 101 sec^{-1} for muon capture from the doublet state of μd. This is to be compared with the theoretical rate of 348 sec^{-1} predicted by the current phenomenological muon capture theory; and it provides the clearest verification of the Pauli exclusion principle effect in muon capture. The neutron rate from muon capture by ^3He was determined to be $(1.20 \pm 0.17) \times 10^3$ sec^{-1}, which is again in good agreement with theory. A theoretical investigation of the μd capture and μ-^3He capture into break-up channels was carried out. Neutron energy spectra for muon capture in the separate μd hyperfine states were obtained, with particular emphasis on the use of two-nucleon wave functions and the inclusion of target-proton momentum terms and induced pseudoscalar terms. The μ-^3He capture processes were studied in the plane-wave approximation, with Gaussian-type wave function for the ^3He nucleus. The results obtained are in fair agreement with the closure-approximation results. (auth)

29255 (NP-14873) EXPERIMENTS ON ELECTRON POLARIZATION (thesis). Johannes Van Klinken (Rijksuniversiteit, Groningen (Netherlands)). 1965. 123p. Dep.(mn).

Six papers are included on studies of electron polarization in beta decay and electron scattering. A calibrated Mott analyzer was developed using a double scattering arrangement, with which the absolute polarization of an electron beam can be measured with 1% accuracy; measurements are reported of the energy and angular dependence of the Mott function at angles of 45 and 105° and at 46 to 204 kev. Measurements were performed on beta-decay electrons whose polarization was converted from longitudinal to transverse by an electric field; results are presented for ^{32}P, ^{60}Co, ^{114}In, ^{147}Pm, ^{147}Nd, ^{153}Sm, and ^{198}Au. It is shown that relative measurements can be performed to 1.8 Mev without calibration; such measurements are reported for ^{198}Au, ^{32}P, and ^{148}Pm relative to the polarization of beta rays from ^{90}Y. The depolarization of beta rays penetrating a thick absorber was investigated: large depolarization was observed for high-Z absorbers and almost none for low-Z absorbers. One section, written in Dutch, presents a survey of studies on allowed beta decay and effects of the parity nonconservation in weak interactions. (M.J.T.)

29256 (NP-15008) HIGH-ENERGY INELASTIC ELECTRON SCATTERING BY OXYGEN 16. [PART] II. Leon Gruenbaum (Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany)). [1963]. 45p. Dep.(mn).

Previous calculations concerning form factors for inelastic electron scattering from ^{16}O targets are extended to include ground state correlations. The odd-parity levels agree well with experiment. For levels with isotopic spin T = 0 the form factors are always larger than without ground state correlations. Levels with isotopic spin T = 1 show the opposite behavior. With ground state correlations for the very collective octopole levels with T = 0, the form factors depend very little on the average nuclear potential but vary strongly with the configuration amplitudes, as in the case without ground state correlations. (auth)

29257 (NP-15012) INELASTIC SCATTERING OF 95-Kev NEUTRONS FROM THE 45-Kev LEVEL IN U^{238}. L. G. Stroemberg and S. Schwarz (Forsvarets Forskningsanstalt. Stockholm (Sweden)). Mar. 1965. 22p. Dep.(mn).

The cross section for inelastic scattering from the first excited (rotational) level in ^{238}U was studied for 95 kev incident neutron energy. The experiment was performed by a time-of-flight method with a ^6Li-glass scintillation detector. The result obtained is ≈60 mb with a statistical error of ≈150 mb. This should be compared to the cross section of ≈450 mb expected from statistical model calculations based on experimental results obtained at higher energies. (auth)

29258 (NP-15050) IZOMERIYA ATOMNYKH YADER S PERIODOM POLURASPADA 10^{-4} SEK ÷ 10^{-1} SEK. (Isomerism of Atomic Nuclei With a Half Life of 10^{-4} to 10^{-1} Sec). V. V. Remaev (Akademiya Nauk Ukrainskii SSR, Kharkov. Fiziko-Tekhnicheskii Institut). 1963. 94p. Dep.(mn).

Methods and apparatus were developed for measuring short-lived isomer activities which permitted to determine

half lives and spectra of isomer γ radiation in the presence of a strong γ background. The efficiency of NaI crystal for γ rays at 0.06 ± 1.5 Mev was estimated in order to determine the absolute intensities of γ transitions. Coefficients of complex (cascade) γ transitions were measured in nuclear reactions with pulsed irradiation and new isomers ^{140m}Nd, ^{141m}Pm, ^{146m}Eu, ^{158m}Gd, ^{197m}Ir, and ^{189m}Ir were found. The existence of the following millisecond isomers: ^{46m}V, ^{71m}Ge, ^{88m}Y, ^{90m}Nb, ^{138m}Ce, ^{180m}W, and ^{209m}Bi was confirmed, and decay schemes are given for the investigated isomers. It is shown that most of the isomer states may be explained in the odd-odd nuclei by octopole transitions (L = 3), in even-odd nuclei by the small variations in excitation energy, in even-even nuclei by the two-particle (pair breakage) excitation. (R.V.J.)

29259 (PPAD-2137-536) X-RAYS EMITTED IN COINCIDENCE WITH THE FISSION OF Cf^{252}. R. A. Atneosen, W. M. Gibson, M. L. Perlman, and T. D. Thomas (Princeton–Pennsylvania Accelerator, Princeton, N. J.). Jan. 26, 1965. Contract AT(30-1)-2137. 22p. (CONF-650301-14). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From Symposium on the Physics and Chemistry of Fission, Salzburg, Austria.

Lifetimes of the K x rays emitted in coincidence with the fission of ^{252}Cf were measured, using a semiconductor fission-fragment detector and a NaI x-ray scintillation counter, placed at given distances from the source. Resulting lifetimes and information on the spectrum of K x rays and the number of K x rays per fission are presented. Results of measurements of the yield and spectrum of electrons emitted in coincidence with the ^{252}Cf fission as a function of the Fragment mass division are also given. (M.J.T.)

29260 (TID-21744) NEUTRON RESONANCE INTEGRAL AND AGE DATA. Reactor Physics Constants Center Newsletter No. 11. A. E. McArthy and P. J. Persiani (Argonne National Lab., Ill.). Jan. 29, 1965. Contract W-31-109-eng-38. 19p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Calculated and measured data accumulated from the literature, by private communication, and by calculations done at ANL, using IBM 704 code ANL-RE-266, are presented. Tables are given of resonance integrals for dilute solutions for isotopes of V, Cu, Zn, Rh, Ru, In, I, Ce, Nd, Sm, Dy, Hf, Ta, Re, Hg, Th, Pa, U, and Pu. Ages of fission neutrons to In resonance energy in H_2O, H_2O-D_2O mixtures, C, Be, BeO, diphenyl, Zr–H_2O mixtures, and Fe–H_2O mixtures are presented. Calculated ages of monoenergetic neutrons to 1.44 ev in H of 6.684 atoms/cc are given for source energies from 0.1 kev to 18 Mev. (M.J.T.)

29261 (TID-21823) MEASUREMENT OF d,pγ DIRECTIONAL CORRELATIONS IN ^{20}F. Ross W. Newsome, Jr. Michigan Univ., Ann Arbor. Dept. of Physics). [1964]. Contract AT(11-1)-1112. 60p. Dep.(mn); $3.00(cy), 2(mn) CFSTI.

The reaction ^{19}F(d,pγ)^{20}F was used to measure the directional correlations of the proton groups in coincidence with subsequent gamma radiations produced in de-excitation of the 2.05, 1.31, 1.06, 0.99 and 0.65 Mev levels of ^{20}F. The effective deuteron energy was 0.448 Mev. A thorough computational comparison between the data and the predicted correlations, based on a plane-wave analysis using postulated spin values which are consistent with the proton angular distribution data, did not yield a unique spin value for any of these levels. (L.B.S.)

29262 (TID-21828) THE DECAY OF W^{187}. J. J. Reidy Michigan Univ., Ann Arbor). [1965]. Contract [AT(11-1)-1112]. 18p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

The gamma rays in the decay of ^{187}W were studied using the U-M curved crystal spectrometer and a Ge(Li) spectrometer. Three previously unreported transitions were observed and the energies of all observed transitions were determined with the curved crystal spectrometer. Upper limits have been determined for the intensities of possible unobserved gamma-rays in the 160-1200 kev region. The relative merits and complementarity of the curved crystal spectrometer and the Ge(Li) spectrometer are discussed. In addition, data are presented concerning the reflectivity of the curved germanium $(0\bar{2}2)$ crystal. (auth)

29263 (WAPD-TM-333(Add.1)) TIME-DEPENDENT FISSION-PRODUCT THERMAL AND RESONANCE ABSORPTION CROSS SECTIONS. Data Revisions and Calculational Extensions. T. R. England (Bettis Atomic Power Lab., Pittsburgh, Pa.). Jan. 1965. Contract AT(11-1)-Gen-14. 51p. Dep.; $3.00(cy), 1(mn) CFSTI.

A set of fission-product data for 179 different nuclides and their formation into linear chains consisting of one to seventeen nuclides is presented. The data include cross sections, half lives, and direct nuclide yields from the fissile nuclides U-233, U-235, U-238, Pu-239, Pu-241, and Th-232. In addition, the linear fission-product chains, extensively discussed in the basic report, have been greatly extended. Based on the new chains and data, extensive tabular and figurative gross absorption cross section and activity results for natural and highly enriched uranium and thorium systems are presented. Where possible, these results are directly compared to those in the basic report. Since the general discussion of fission products and method of treatment presented in the latter report are not repeated, familiarity with the subject is assumed. Use of the new data requires no qualitative change in previous conclusions, and there is little quantitative change in results for those reactor fuels and irradiation times already covered. However, new results are presented. In addition, a 12 chain set consisting of 32 nuclides has been abstracted from the total 367 linear nuclide, 69 chain representation. These 32 are found to account for most of the gross poison and its significant spectrum dependence, power dependence, and transient behavior. The reduced representation is found to be practical for point use in large spatial depletion calculations. (auth)

29264 CONTRIBUTIONS TO THE APPLICATION OF THE NILSSON WAVE FUNCTION TO ATOMIC NUCLEI IN THE 150 < A < 188 REGION. (Thesis, 60 references). Dragos Bogdan (Inst. of Atomic Physics, Bucharest). Acad. Rep. Populare Romine, Studii Cercetari Fiz., 15: 415-70 (1964). (In Rumanian)

The existence of large quadrupole moments in the case of certain nuclei implies that they do not possess a spheric symmetry. The specific effects of rotational spectra, such as the ground state spin or the moment of inertia depend on the eigenvalue of the nucleus, i.e., on the movement of the nucleons in a self-consistent deformed field. S. G. Nilsson calculated the bound states of nucleons at an anisotropic oscillating potential. His function was used for further study. Formulas were derived for determining the quadrupole moments; in these calculations an operator was used, which does not imply any theory concerning the movement of the nucleons beyond the adiabatic theory, together with a second operator based on a medium that possesses a hydrodynamic character. Applying the formulas derived to nuclei with 150 < A < 188, it was found that a corrected representation must be used for calculating the quadrupole moments. The M3 type γ transitions of deformed nuclei, such as ^{181}Ta, ^{179}Hf, and ^{179}W were examined. No forbidden second-order β^- transition was observed in the case of deformed nuclei. The results indicated that in many cases the corrected Nilsson function must be used; it was also found that the Nilsson model is useful for calculating transition probabilities. (TTT)

29265 DETERMINATION OF THE ATOMIC ELECTRON BINDING ENERGIES IN ELEMENT 97. J. M. Hollander, M. D. Holtz, T. Novakov, and R. L. Graham (Univ. of California, Berkeley). Arkiv Fysik, 28: 375-9(1964). (UCRL-11486)

The atomic electron binding energies of element 97 (berkelium) were measured with use of a high-precision iron-free beta spectrometer. The method employed involves the use of known conversion-electron sum relations in the decay of ^{253}Es plus precisely determined conversion electron energies in order to determine the absolute energies of the 51.9- and 43.0-kev transitions in ^{249}Bk. The individual subshell binding energies are

determined by subtracting the measured energies of the corresponding subshell electrons from the transition energies. The K-binding energy is calculated from the sum of the ($K - L_1$) electron energy difference and the L_1 binding energy; the resulting K-value is at least 150 ev higher than the extrapolated values given in published tables. The subshell binding energies are tabulated and their errors are discussed. (auth)

29266 AVERAGE NUMBER OF PROMPT NEUTRONS EMITTED IN THE NEUTRON INDUCED FISSION OF Th^{232}. H. Conde and M. Holmberg (Research Inst. of National Defence, Stockholm). Arkiv Fysik, 29: 33-43(1965).

The energy dependence of $\bar{\nu}$ prompt for the neutron induced fission of ^{232}Th was investigated. The fission neutron detector was a large liquid scintillator. The data from 1.6 to 14.9 Mev of incident neutron energy can be fitted by a straight line $\bar{\nu}(E_n) = 1.849 + 0.154\ E_n$. The $\bar{\nu}$-value at 1.4 Mev is above this line. (auth)

29267 AVERAGE NUMBER OF NEUTRONS FROM THE FISSION OF U^{235}. H. Conde (Research Inst. of National Defence, Stockholm). Arkiv Fysik, 29: 293-9 (1965).

An accurate determination of the average number of prompt neutrons ($\bar{\nu}_{th}$) emitted in the thermal fission of ^{235}U was made. The result, $\bar{\nu}_{th}(^{235}U) = 2.411 \pm 0.023$, is compared with other recent measurements and an average thermal $\bar{\nu}$-value is derived, $\bar{\nu}_{th}(^{235}U) = 2.412 \pm 0.015$. The prompt $\bar{\nu}$-values for ^{235}U at 7.5 and 14.8 Mev of incident neutron energies were also measured. The results were $\bar{\nu} = 3.49 \pm 0.06$ at 7.5 Mev and $\bar{\nu} = 4.47 \pm 0.09$ at 14.8 Mev. (auth)

29268 A MEASUREMENT OF PROMPT $\bar{\nu}$ FOR PHOTOFISSION OF U^{238}. M. Holmberg and H. Conde (Research Inst. of National Defence, Stockholm). Arkiv Fysik, 29: 301-6(1965).

A measurement of $\bar{\nu}$ in the photofission of ^{238}U at a gamma energy of 7 Mev was made. The result, $\bar{\nu} = 2.77 \pm 0.13$, is not in agreement with measurements by Prokohorova and Lazareva. The spontaneous fission of ^{240}Pu and the thermal-neutron fission of ^{239}Pu give a difference in $\bar{\nu}$ corresponding to 0.11 neutrons per Mev. The result of the present investigation combined with the $\bar{\nu}$-value for the spontaneous fission of ^{238}U gives 0.11 ± 0.02 in agreement with the data obtained for the compound nucleus of ^{240}Pu. (auth)

29269 FISSION NEUTRON SPECTRA. PART II. FISSION NEUTRON SPECTRA OF U^{235}, Pu^{239}, AND Cf^{252}. H. Conde and G. During (Research Inst. of National Defence, Stockholm). Arkiv Fysik, 29: 313-19(1965).

Measurement of the fission neutron spectra from the neutron induced fission of ^{235}U and ^{239}Pu and the spontaneous fission of ^{252}Cf was made. The spectra were measured with a time-of-flight technique using a plastic scintillator as the fission neutron detector. The low energy part of the ^{252}Cf fission neutron spectrum (below 0.3 Mev) was measured with a ^{6}Li-glass detector replacing the plastic scintillator. The fissile materials were mounted in xenon-gas scintillation chambers. The primary neutrons were produced by a 2.5 Mev Van de Graaff accelerator with top terminal pulsing. The resolving time of the time-of-flight equipment was better than 3 nanoseconds. Results fitted to Maxwellian distribution, $\sqrt{E}e^{-E/T}$, are presented for neutron induced fissions of ^{235}U at 40 kev and 1.5 Mev and for ^{239}Pu at 40 kev of incident neutron energy. Results are also given for the fission neutron energy spectrum of ^{252}Cf. (auth)

29270 TRANSITIONS IN THE DECAY OF Au^{192}. B. Nyman, S. Antman, C. Bergman, and G. Baeckstroem (Inst. of Physics, Uppsala). Arkiv Fysik, 29: 321-8(1965).

Internal conversion transitions in ^{192}Pt following the electron capture and positon decay of ^{192}Au were studied using a double-focussing iron-yoke beta spectrometer. A total number of 105 transitions can be ascribed to the decay of ^{192}Au. The half life of ^{192}Au was determined to be 5.04 ± 0.15 hr. (auth)

29271 GAMMA SPECTRA FROM MIXED FISSION PRODUCTS OF AGES BETWEEN 2 HOURS AND 7 DAYS. Kerstin Loew and K. Edvarson. Arkiv Fysik, 29: 359-65 (1965).

The gamma spectra of mixed fission products of ages between 2 hours and 7 days were measured for thermal neutron fission of ^{235}U and ^{239}Pu and fast neutron fission of ^{235}U. The results are summarized in diagrams, where the ratios between the intensities in a number of energy bands in the measured spectra are given as a function of age. For comparison the photon spectra for MFP from ^{235}U thermal fission, were calculated for the same time period. (auth)

29272 NEUTRON GROUPS FROM THE BERYLLIUM-9(α,n) REACTION AND LEVELS IN CARBON-13. D. E. Groce and B. D. Sowerby (Australian National Univ., Canberra). Nature, 206: 494-5(May 1, 1965).

A beryllium target was bombarded with $^{4}He^{2+}$ ions at 2 to 12 Mev from a Van de Graaff accelerator, and neutrons from the $^{9}Be(\alpha,n)$ reaction were measured using a liquid scintillation counter with a pulse height analyzer. An IBM 1620 computer program was used to determine the neutron yields from the ground and first excited states in carbon-12 at each alpha energy. The excitation functions are shown and the observed resonances are listed. (L.B.S.)

29273 FUNDAMENTAL EXAMINATION OF ENERGY DISTRIBUTION OF THE EXTERNAL BETA RADIATION BY RADIOPHOSPHORUS ^{32}P. Hiroshi Isobe (Tohoku Univ., Sendai). Nippon Igaku Hoshasen Gakkai Zasshi, 24: 1094-9(Dec. 1964). (In Japanese)

The spectral energy distribution for a large number of beta-ray emitters was measured by means of magnetic beta-ray spectrometers. An external beta irradiation method with ^{32}P was investigated by various measuring methods. A β-ray scintillation spectrometer method was used, and the shape of ^{32}P beta spectrum was measured. The ^{32}P β source and β detector were set in an air tank. Air pressure in the tank was varied from 20 mmHg to 4.5×10^3 mmHg by using a vacuum pump and an air compressor. It was found that the distribution of β-spectra of ^{32}P is close to the Fermi theoretical curve for a thin absorber (within about 0.2 mg/cm^2), and systematic deformation was observed. (auth)

29274 ANGULAR DISTRIBUTIONS OF THE REACTIONS C^{12}(d,p), N^{14}(d,ALPHA) AND Al^{27}(d,ALPHA). J. H. Williamson (Cambridge Univ., Eng.). Nucl. Phys., 69: 481-501(July 1965).

Angular distributions were measured for $^{12}C(d,p)^{13}C$, $^{14}N(d,\alpha)^{12}C$, and $^{27}Al(d,\alpha)^{25}Mg$ below $E_d = 2.0$ Mev. The results from the first reaction are explained in terms of overlapping compound nucleus levels and statistical theory is used for the (d,α) reactions. A new form of nitrogen target is described. (auth)

29275 ANGULAR CORRELATION ANALYSIS IN COMPOUND NUCLEUS REACTIONS. F. Cristofori and P. G. Sona (C.I.S.E., Milan). Nucl. Phys., 69: 502-12 (July 1965).

The angular correlation analysis of a compound nucleus reaction is extended to large energy intervals, when slow variations with the energy of the penetrabilities and of the number of competing channels are taken into account. A slightly modified definition of the correlation function is given, which allows the derivation of explicit formulas, suitable for comparison with the experimental data. Formulas for the average differential cross section are also obtained. (auth)

29276 PROTON REACTION CROSS SECTIONS AT 8.8 Mev. P. J. Bulman, G. W. Greenlees, and M. J. Sametband (Univ. of Birmingham, Eng.). Nucl. Phys., 69: 536-44(July 1965).

Proton reaction cross sections at 8.8 Mev are given for Al, V, Fe, Co, ^{58}Ni, ^{60}Ni, ^{63}Cu, ^{65}Cu, Cu, Zn, and Ga. An anticoincidence technique was used, and the results are discussed in terms of optical model predictions. (auth)

29277 STATISTICAL PROPERTIES OF LEVELS OF U^{236} INDUCED IN U^{235} BY SLOW NEUTRONS. A. Michaudon, H. Derrien, P. Ribon, and M. Sanche (Centre d'Etudes Nucleaires, Saclay, France). Nucl. Phys., 69: 545-72(July 1965). (In French)

The neutron induced fission and total cross sections of ^{235}U were measured up to 20 kev, and the resonances were analyzed up to 150 ev. Their parameters are given. It is shown that about 20% of the levels are missing, corresponding to small level spacings and small values of $2g\Gamma_n$. This effect is mainly due to the ^{235}U resonant structure rather than to the resolution or the experimental conditions, as have been checked by a Monte-Carlo calculation. The value of the strength function is $S_0 = (0.915 \pm 0.05) \times 10^{-4}$ ev with a mean level spacing $\langle D \rangle = 0.53 \pm 0.03$ ev. The radiation widths fluctuate strongly from resonance to resonance and their distribution is consistent with a Porter-Thomas distribution having $\nu = 32$ degrees of freedom. The number of degrees of freedom deduced from the distribution of the fission widths is $\nu = 4$. There appears to be a strong correlation between fission and capture widths which can be tentatively related to two different mean values of both widths for the two spin states. There seems also to be some correlation between levels over a range smaller than 100 ev. But there is no correlation between neutron widths and fission or capture widths. (auth)

29278 TERNARY FISSION INDUCED IN U^{235} BY RESONANCE NEUTRONS. A. Michaudon, A. Lottin, D. Paya, and J. Trochon (Centre d'Etudes Nucleaires, Saclay, France). Nucl. Phys., 69: 573-86(July 1965). (In French)

The process of ternary fission of ^{235}U by resonance neutrons with emission of long range α particles was studied by the time-of-flight method using the Saclay linear accelerator. The detector is an ionization chamber containing five separate chambers, one for detecting binary fission, the four others for detecting ternary fission. The analysis of 22 resonances shows a change of both the probability of emission and the spectrum of the ternary alphas from resonance to resonance. The higher the energy of the α particle, the more likely is its probability of emission proportional to binary fission. (auth)

29279 ENERGY AND ANGULAR DISTRIBUTION OF THE REACTION Ag(n,ALPHA)Rh AT 14 Mev. K. Breuer and E. Roessle (Universitat, Frankfurt am Main). Nucl. Phys., 69: 587-92(July 1965).

The energy and angular distributions of the α particles from the reaction $Ag(n,\alpha)Rh$ at a neutron energy of 14 Mev were studied using nuclear emulsions for the detection of the α particles. The angular distribution is strongly peaked in forward direction, the forward to backward ratio for all energies being 3.0 ± 0.3. (auth)

29280 CLASSIFICATION OF STATES BY QUASI-SPIN IN LS COUPLING. K. Helmers (Universitat, Hamburg). Nucl. Phys., 69: 593-611(July 1965).

The simultaneous classification of states in LS coupling in terms of Racah's orthogonal group and the quasi-spin group is studied. The classification is found to be complete, in analogy to the case of jj coupling. It turns out that an extension of the proper orthogonal quasi-spin group to a full orthogonal group is possible and useful. (auth)

29281 EXCITATION FUNCTIONS AND MEAN RECOIL RANGES RESULTING FROM THE BOMBARDMENT OF ^{56}Fe WITH 18-68 Mev ^4He IONS. Alan Ewart, Constance Valentine, and Marshall Blann (Univ. of Rochester, N. Y.). Nucl. Phys., 69: 625-36(July 1965).

Cross sections and mean recoil ranges are reported for products of the $(\alpha, 3n)$, $(\alpha, 4n)$, (α, pn), $(\alpha, p2n)$, $(\alpha, p3n)$, and $(\alpha, p4n)$ reactions of ^{56}Fe. The helium ion kinetic energy varied between 18 and 68 Mev. Targets were 99.7% enriched ^{56}Fe for bombardments with $E_\alpha > 43$ Mev; natural iron targets foils were used for $E_\alpha < 43$ Mev. The experimental recoil ranges of reaction products formed between reaction thresholds and the corresponding excitation function peaks are compared with the ranges predicted by the theory of Lindhard, Scharff, and Schiott, and are found to agree to within 10% experimental uncertainty. Recoil ranges for ^{56}Ni, ^{57}Ni, ^{55}Co, and ^{56}Co are consistent with reactions proceeding predominantly by a compound nucleus mechanism over the entire energy range of this work. Recoil ranges for ^{58}Co show large contributions from incomplete momentum transfer reactions for bombarding energies in excess of 45 Mev, corresponding to the high energy tail of the excitation function. Ranges of ^{57}Co are consistent with full momentum transfer up to 60 Mev bombarding energy. (auth)

29282 PROTON-NUCLEUS COLLISIONS IN THE MULTI-Gev REGION. H. Winzeler (Universitat, Bonn). Nucl. Phys., 69: 661-94(July 1965).

A proton path of 1 km was followed in nuclear emulsions, and the statistics of the secondary tracks of 2661 stars is given. The primary energies were 6.2 and 22.5 Bev. While at the higher energy the average number of shower tracks is about two times larger than at the lower one, the frequency of the heavy tracks ($n_h = n_g + n_b$) shows practically no change, or might even be slightly lower at the higher energy. Such an effect is probably due to the influence of jet contraction with increasing energy. The angular and momentum distributions of the gray tracks are peaked forward but are insensitive to the primary energy. These and other observations can be attributed to the (known) energy independence of the recoil nucleons properties in collisions of high-energy particles with nucleons. The occurrence of exponential frequency distributions as functions of heavy or gray track numbers on the one hand and the observations of an exponential distribution of the cross section for spallation on the other hand are discussed. Some support is given to the view that at these energies the nuclear break-up is mainly caused by the (slow) recoil particles from the x-nucleon collisions of the fast particles in the internal jet. Consideration of average numbers of shower tracks for p−p and p-nucleus collisions for different primary energies and comparison of $\langle n_s \rangle$ and $\langle n_g \rangle$ with results of existing Monte-Carlo calculations suggest that for the shower particles the effective target mass for single collisions is close to that of one nucleon. However, at 22 Bev there seems already to be an influence of the overlapping of the shower particles internal paths. This fact was not taken into account in the cascade calculations. (auth)

29283 THEORY OF NUCLEAR REACTIONS. VIII. TIME EVOLUTION OF THE SCATTERING PROCESS. L. Rosenfeld (NORDITA, Copenhagen). Nucl. Phys., 70: 1-27(Aug. 1965).

The scattering of a neutral spinless particle by a fixed spherically symmetrical potential of finite range is treated as a time dependent process, for a simple form of initial wave packet. The variation in time of the wave packet in the external region is analyzed, with special emphasis on the decay after very long times of the transient components. The competition between the components decaying as the $-3/2$ power of the time and those decaying exponentially is discussed, and the validity of the exponential decay law for resonant states established for a very wide range of time intervals. The physical interpretation of the resonant states as exponentially decaying states is thus put on a firm basis; it is further shown that the amplitudes of the corresponding wave functions always remain finite in space. On the other hand, it appears that no such simple interpretation can be given of the virtual states. (auth)

29284 MEASUREMENT OF THE g-FACTOR OF THE FIRST EXCITED STATE IN Pd^{106}. H. J. Koerner and U. Ortabasi (Universitat, Hamburg). Nucl. Phys., 70: 28-32(Aug. 1965).

The gyromagnetic ratio of the 0.513 Mev first vibrational state of ^{106}Pd was determined by perturbed angular correlation methods to be $g = +0.45 \pm 0.06$. (auth)

29285 ROTATION VIBRATION INTERACTION IN DEFORMED NUCLEI. Amand Faessler (Universitat, Freiburg i. B.), Walter Greiner, and Raymond K. Sheline. Nucl. Phys., 70: 33-88(Aug. 1965).

The rotation vibration model for deformed nuclei is

summarized, various matrix elements are given explicitly and multipole operators are evaluated. The rotation vibration Hamiltonian is diagonalized up to spin 20 and presented in a manner which is independent of the individual nucleus. Energies and wave functions for the various states in the ground state, beta and gamma rotational bands of even deformed nuclei are given in an extensive table. The use of the table is explained in detail. An extensive comparison of the rotational vibration model and the asymmetric rotator model with available experimental data indicates an approximate equivalence of the two theories in explaining the three lowest rotational bands. However, the rotation vibration model appears to have a decided advantage in explaining the few two-phonon vibrations experimentally observed. Small systematic deviations between the rotation vibration model and experiment for the energies of the vibrational bands are interpreted in terms of the Coriolis anti-pairing and blocking effects. These effects lead to lower limits on the pairing correlation energy and the critical spin above which all pairing ceases. (auth)

29286 THE REACTION $Ni^{58}(n,p)Co^{58}$ AT DIFFERENT NEUTRON ENERGIES. K. Debertin and E. Roessle (Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main). Nucl. Phys., 70: 89-96(Aug. 1965).

The energy and angular distributions of the protons from the reaction $^{58}Ni(n,p)^{58}Co$ at incident neutron energies E_n = 8.4, 14.1, and 22.0 Mev were studied. The measurements at E_n = 8.4 Mev yield an isotropic angular distribution while especially at E_n = 22 Mev the angular distribution of the high-energy protons is strongly peaked forward. Parts of the energy spectra were used to evaluate level density parameters for the residual nucleus ^{58}Co. At E_n = 22 Mev deuteron spectra were also recorded. (auth)

29287 THE $He^3 + d \rightarrow t + 2p$ REACTION. M. Jakobson, J. H. Manley, and R. H. Stokes (Los Alamos Scientific Lab., N. Mex.). Nucl. Phys., 70: 97-113(Aug. 1965). (LA-DC-6733)

The energy spectra of tritons produced in the $d + {}^3He \rightarrow t + 2p$ reaction were obtained at numerous angles by bombardment of a ^3He gas target by 11.7 and 14.0 deuterons and of a deuterium gas target by 21 Mev ^3He ions. The spectra are markedly dependent on the angle of observation, but exhibit a shape which can be interpreted as influenced by a final state interaction in the residual two-proton system. Absolute cross sections were obtained. Mass identification was with ΔE and E detector pulses operating an analogue computer system. Spectral data were taken with various energy resolutions, fwhm in the range from 120 to 400 kev; laboratory angles from 4 to 36° were covered with an angular acceptance of better than 0.8°. The 14 and 21 Mev experiments were designed to cover practically the whole c.m. angular range. The angular distributions, parametrized in terms of residual energy of the diproton system, show marked structure suggestive of both charge exchange and stripping mechanisms modulated in a complex fashion by the 2p final state interaction. The results suggest that in systems of this type final state interaction parameters cannot be extracted without detailed attention to the recent mechanism. Comparison of this reaction channel with the elastic and the $\alpha + p$ exit channels indicates similarities which should be exploited in theoretical studies of this five-body system. (auth)

29288 THE (p,2p) INTERACTION FOR 50 Mev ON CARBON AND CALCIUM. W. R. Gibson (Queen's Univ., Belfast), A. R. Johnston, and R. J. Griffiths. Nucl. Phys., 70: 114-22(Aug. 1965).

Absolute differential cross sections for the (p,2p) direct interactions in carbon and calcium were measured for 50-Mev incident protons. The ejection of protons from the p state in carbon has been identified through the summed energy spectrum of the outgoing protons and the angular correlation for protons from these events was measured. These results are compared with an improved version of a distorted wave Born approximation calculation developed by Lim and McCarthy. The theory predicts two minima, the maximum between these being due to the distortion of the wave functions of the incoming and outgoing protons in the nuclear field. The experimental results cover the angular range which includes this maximum and the minimum at large angles and are in reasonable agreement with the theoretical cross sections. In the case of calcium it was not possible to separate the 2s state and 1d state scattering events in the summed energy spectrum but the shape of the combined angular correlation curve for both states is similar to that obtained at 180 Mev. (auth)

29289 THE EFFECT OF POLARIZATION ON THE FLUCTUATIONS IN NUCLEAR CROSS-SECTIONS. R. O. Stephen (Yale Univ., New Haven). Nucl. Phys., 70: 123-8(Aug. 1965).

The effect of including polarization on the statistical properties of fluctuating cross sections is examined. The theory of cross-section fluctuations as developed by Ericson and Brink and Stephen pictures a compound nucleus reaction as a Gaussian random process. For simplicity only spin one half particles are considered. It will be shown that a comparison of the results with the well-known fluctuation formula for the number of statistical degrees of freedom suggests that polarized spin one half particles have $2/(1 + P^2)$ as many degrees of freedom as polarized particles. The results suggest that it may be possible to measure the mean polarization in a reaction by merely observing the damping of the fluctuations. (auth)

29290 THE DECAY OF Tc^{95m}. T. Cretzu, K. Hohmuth, and J. Schintlmeister (Zentralinisitut fur Kernforschung, Rosendorf, Ger.). Nucl. Phys., 70: 129-40(Aug. 1965). (In German)

The decay of ^{95m}Tc was investigated using a scintillation spectrometer with a two-dimensional coincidence arrangement, a magnetic beta-ray spectrometer and a proportional counter. Two new gamma transitions with energies of 970 and 1630 kev were found. The analysis of the β^+ spectrum yields two beta rays with maximum energies of 700 ± 10 and 492 ± 15 kev. Relative intensities of the gamma rays were determined by analyzing the measured gamma spectra and taking into account $e-\gamma$ coincidence experiments. From these data and the intensities of the conversion electrons the internal conversion coefficients for the gamma transitions in ^{95}Mo were calculated. The decay scheme of ^{95m}Tc is given. (auth)

29291 THE LIFETIME OF THE 75-kev LEVEL OF Dy^{161}. K. M. M. S. Ayyangar, V. Lakshminarayana, and Swami Jnanananda (Andhra Univ., Waltair, India). Nucl. Phys., 70: 141-4(Aug. 1965).

The lifetime of the 75-kev level of ^{161}Dy was measured with a time-to-amplitude converter and found to have a half life of 2.95 ± 0.15 ns. A retardation factor of 115 for the 49-kev M1 transition, and a retardation factor of 10^4 for the 75-kev E1 transition are observed. In a comparison of the experimental transition probabilities with Nilsson's estimates, the retardation factors are found to be 6.8 and 7.6 for the 49 and 75-kev transitions, respectively. (auth)

29292 THE DEUTERON DISINTEGRATION IN FLIGHT OCCURRING DURING THE SCATTERING OF 26 AND 23 Mev DEUTERONS ON GOLD AND COPPER. F. Udo and L. A. Ch. Koerts (Instituut voor Kernphysisch Onderzoek, Amsterdam). Nucl. Phys., 70: 145-69(Aug. 1965).

Correlation experiments are reported concerning the (d,pn) reaction between 26 and 23 Mev deuterons and the target nuclei gold and copper. The angular correlation of the outgoing particles, the spectra of the coincident protons, and the magnitudes of the cross sections are given. The data lead to the conclusion that the dissociation of the deuterons in the Coulomb field of the nucleus is primarily responsible for the observed reaction. However, the theories available at present are not accurate enough to describe the deuteron disintegration in detail. (auth)

29293 BETA-GAMMA CIRCULAR POLARIZATION CORRELATION OF Sb^{122}. Z. W. Grabowski, R. S. Raghavan, and R. M. Steffen (Purdue Univ., Lafayette, Ind.). Nucl. Phys., 70: 170-6(Aug. 1965).

The angular dependence of the circular polarization of the 566-kev gamma radiation following the first-forbidden 1400-kev β transition of ^{122}Sb was studied. The β-γ circular polarization correlation is consistent with a cos θ dependence. The value of the β-γ circular polarization anisotropy factor $A_1(\beta)$ in the correlation function $W(\theta,\tau) = 1 + \tau A_1(\beta)A_1(\gamma)P_1(\cos\theta) + A_2(\beta)A_2(\gamma)P_2(\cos\theta)$ is $A_1(\beta) = (0.09 \pm 0.04)$p/W. The data confirm that shape and the angular correlations of the 1400 kev β-transition of ^{122}Sb are well described by the Coulomb approximation. The ratio of scalar type to vector type matrix element components in this β transition is (in Kotani's notation): $x_1 = [C_A \int i\gamma_5 + (\alpha Z/2R)C_A \int \sigma \cdot r]/[-C_V \int i\alpha - (\alpha Z/2R)(C_A \int i\sigma \times r - C_V \int r)] = 13^{+10}_{-5}$ or $x_2 = 0.29 \pm 0.04$. The second solution can be excluded on the basis of angular distribution data from oriented nuclei. The β-γ circular polarization correlation results obtained make it possible to reduce the number of solutions obtained by Pipkin et al. for the six nuclear matrix elements which enter into the $2^- \rightarrow 2^+$ 1400 kev β transition of ^{122}Sb. (auth)

29294 ANALYSIS OF THE SCATTERING OF 28 Mev ALPHA PARTICLES. G. R. Satchler (Oak Ridge National Lab., Tenn.). Nucl. Phys., 70: 177-95(Aug. 1965). (ORNL-p-990)

The elastic and inelastic scattering of 28-Mev alpha particles from the nuclei Ne, Mg, Al, Si, Ti, Ni, Co, Ag, Cd, and Sn was analyzed using a non-spherical optical model potential and the distorted wave approximation. A four-parameter Woods-Saxon potential was used. Good fits are obtained for the medium weight and heavy nuclei, qualitative fits for the lighter nuclei. The deformabilities extracted are in good agreement with those found by other methods. Coulomb excitation is found to be important for the heavy nuclei. Some account is taken of quadrupole contributions to the elastic scattering from Al. (auth)

29295 EFFECT OF THE NUCLEAR SURFACE DENSITY OF THE SCATTERING OF 40 Mev ALPHA-PARTICLES FROM IODINE AND XENON. D. J. Prowse (Univ. of California, Los Angeles). Nucl. Phys., 70: 196-202(Aug. 1965).

The elastic scattering of 40-Mev α particles from iodine and xenon was measured and interpreted on the basis of the nuclear optical model. It was found that families of optical model potentials fit the data provided that the rounding parameters a and the values of $\log V_0 + R/a$ are held constant (V_0 is the potential at r = 0 in the Saxon-Woods form and R is the nuclear radius). However it is found that the families that satisfactorily fit the data are different for iodine and for xenon in the direction which makes the iodine nucleus more diffuse than the xenon nucleus. (auth)

29296 GAMMA-GAMMA DIRECTIONAL CORRELATIONS IN Dy^{160}. S. L. Gupta and N. K. Saha (Univ. of Delhi). Nucl. Phys., 70: 203-8(Aug. 1965).

The gamma-gamma angular correlation of the three cascades 215–960, 298–964, and 298–877 kev of ^{160}Dy following the beta decay of ^{160}Tb was studied using the coincidence method. Particular care was taken to estimate the contribution of interfering cascades to the first one. The expansion coefficients obtained are consistent with a spin sequence 2(D,Q)3(D,Q)2 within the experimental error. The mixing-ratio analysis yields 960-kev radiation to be almost pure E2 with a very slight ($\leq 0.9\%$) admixture of M1. Measurements on the other two cascades yield spin sequences and the multipolarities of the 298 and 877-kev radiations in excellent agreement with the measurements of previous workers. (auth)

29297 ANGULAR DISTRIBUTIONS IN PHOTOFISSION OF THORIUM AND URANIUM. E. Albertsson and B. Forkman (Univ. of Lund, Sweden). Nucl. Phys., 70: 209-18(Aug. 1965).

The angular distributions in photofission of thorium and uranium were measured. Both bremsstrahlung with a maximum energy of 6.5 Mev and mono-energetic gamma radiation of 6.1, 6.9, and 7.1 Mev were used as photon sources. The fission fragments were detected in soaked emulsions. Strong anisotropy in the angular distribution was observed. The increase of the isotropic term with excitation energy was compared to reported values. These were fitted to a penetration function and a channel fission analysis was performed. (auth)

29298 MATRIX ELEMENTS OF INTEGRABLE NUCLEAR TENSOR OPERATORS. P. J. Roberts (Univ. of Glasgow). Nucl. Phys., 70: 219-24(Aug. 1965).

Explicit expressions are given for the matrix elements of two-particle nuclear tensor operators present in the asymptotic one-pion exchange potential. The functional forms of the potentials V(r) are not prescribed beyond the requirement that they should be integrable. A basis of orbitals with radial factors of the form $r^{2n+l} \exp(-ar^2)$ is used. The results are given in closed form and are very much simpler than previous formulas given by Nesbet and Talmi. (auth)

29299 EFFECTS OF NON-LOCALITY IN OFF-DIAGONAL POTENTIALS. F. G. Perey and A. M. Saruis (Oak Ridge National Lab., Tenn.). Nucl. Phys., 70: 225-35(Aug. 1965). (ORNL-TM-967)

The effects of non-locality in the off-diagonal parts of the optical potential are studies in distorted-wave Born approximation by using a local energy approximation. The effects are found to be very small in the case of inelastic scattering to low-lying collective states because of the small Q value and the approximate equality usually assumed for the distorting potentials in the initial and final channels. For (p,n) reactions to isobaric analogous states, because of the large Q value and the differences between distorting potentials, the effects are found to be appreciable but mostly change the magnitude of the cross section (auth)

29300 THE FIRST EXCITED STATE OF B^9. M. M. Islam and P. B. Treacy (Oxford Univ.). Nucl. Phys., 70: 236-40(Aug. 1965).

Spectra of α particles and protons from 13-Mev proton bombardment of ^{12}C were investigated in a search for a broad first excited state of ^{9}B. Evidence is given for transitions in the $^{12}C(p,\alpha)^9B$ reaction to the ground state, 2.34-Mev state and a broad state at 1.50 ± 0.05 Mev in ^{9}B. The continuum α background is accounted for as due to sequential decay via the 9.64-Mev state of ^{12}C plus a contribution either via states of ^{5}Li or direct many-body breakup. (auth)

29301 MEASUREMENT OF THE MÖSSBAUER RECOILLESS FRACTION IN BETA-Sn FOR 1.3 TO 370°K. C. Hohenemser (Washington Univ., St. Louis). Phys. Rev., 139: A185-96(July 5, 1965).

Doppler-shift measurements of Mössbauer recoilless fractions f in β-Sn show discrepancies of the order of 20 to 30% and sometimes bear quoted errors of ±10%. Such discrepancies can be caused by using incorrect values of α, the internal conversion coefficient; τ_m, the mean life of the excited state; Γ_A and Γ_S, the absorber and source linewidths; and B, the nonresonant background present in the detector at the energy of the Mössbauer γ rays. The use of a black resonant absorber and the technique x-γ delayed coincidences combine to eliminate dependence on these parameters in first approximation. In particular, the results $f = 0.455 \pm 0.010$ at 77.3°K and $f = 0.72 \pm 0.01$ at 4.2°K are obtained. The errors are systematic, and are due largely to uncertainties in evaluating the residual resonant transmission of the black absorber, the total magnitude of which is about 5% for T ≤ 100°K. For the experimental temperature range of $1.3 \leq T \leq 370$°K, f values are obtained at over 300 points for two different source samples. The results are as much as 20% higher than some previously reported values, and also do not agree well with the theoretical calculations of DeWames, Wolfram, and Lehman for T ≤ 150°K. On the other hand, when the data are expressed in terms of a Debye temperature Θ derived at each temperature from the Debye formula for f, the Θ values show remarkably little variation with temperature, and fall on

a smooth curve. The results at low temperature help to clarify the data of Wiedemann, Kienle, and Pobell in the superconducting region and immediately above. (auth)

29302 SHAPE OF THE LOW-ENERGY SPECTRUM FOR COULOMBIC INTERACTIONS. C. O. Carroll (Nuclear-Chicago, Des Plaines, Ill.) and R. F. O'Connell. Phys. Rev. Letters, 14: 840-2(May 17, 1965).

It is shown that for reactions in which the particles are described by Coulomb wave functions and the interaction Hamiltonian is independent of momentum, the shape of the momentum spectrum near threshold is parabolic or, equivalently, the shape of the energy spectrum is linear. (D.C.W.)

29303 LOWER LIMIT OF THE ABSORPTION RATE OF K⁻'S AT REST IN LIQUID HYDROGEN. M. Cresti, S. Limentani, A. Loria, L. Peruzzo, and R. Santangelo (Istituto di Fisica Galileo Galilei, Padua and Istituto Nazionale di Fisica Nucleare, Padua). Phys. Rev. Letters, 14: 847-9 (May 17, 1965).

The absorption of mesons (K^-) at rest in liquid hydrogen was investigated by exposing a bubble chamber to a stopping meson (K^-) beam. A lower limit of 1.1×10^{11} sec^{-1} was obtained for the absorption rate. (D.C.W.)

29304 ON THE EFFECT OF PAULI PRINCIPLE ON COLLECTIVE VIBRATIONS IN NUCLEI. Kiyomi Ikeda (Nihon Univ., Tokyo), Takeshi Udagawa, and Hajime Yamaura. Progr. Theoret. Phys. (Kyoto), 33: 22-37 (Jan. 1965).

The earlier theories of collective vibrations based on the random phase approximation have neglected the effect of the Pauli principle. A method to take into account this effect is developed for the simple model with the pairing plus Q-Q interactions. It is shown that the correction is appreciable on the properties of the vibrational states. The effect is found to be particularly important for a vibrational state with low frequency. This fact plays an essential role in reproducing the experimental mass number dependence of the energies of the vibrational states. The numerical calculations are carried out for the first vibrational 2^+ states of even nuclei. The results agree remarkably well with the experimental systematics for these nuclei with a constant strength of the Q-Q interactions. (auth)

29305 STATES OF MIXED SYMMETRY IN LIGHT NUCLEI. Michel Fabre de la Ripelle (Universite de Paris, Orsay, France). Progr. Theoret. Phys. (Kyoto), 33: 38-42(Jan. 1965). (In French)

From the difference between the singlet and triplet nuclear potential, a mixed symmetry state admixture in the wave function of nuclei results. In the case of the 4n + 3 nuclei, if the wave function is constructed as the antisymmetrized product of the wave functions of a core of 4n nucleons and of 3 external nucleons, the mixed symmetry state of the 3 external nucleons gives a cross term in the Coulomb energy which is responsible for the different behavior in the Coulomb energy for the 4n + 3 and 4n + 1 nuclei. An estimate derived from the mirror nuclei data gives a contribution of around 3% of mixed symmetry state for the levels l = 1 (8 < A < 16) and 1.5% for the levels l = 2 (16 < A < 28). (auth)

29306 3-3 RESONANCE EFFECT IN THE NUCLEUS. Yoshitaka Kimura and Yorikiyo Nagashima (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 33: 43-54(Jan. 1965).

From the viewpoint that the nuclear many-body effects can be taken into account by applying the Pauli exclusion principle to the intermediate state of the nucleon, various processes in the nucleus are discussed. It is shown that in the nucleus the peak of the 3-3 resonance in π-N scattering is remarkably reduced, and its position shifts towards higher energy by 200 Mev. A 22.5% reduction of the anomalous magnetic moment of the nucleon and considerable modification of the optical model potential for pion-nucleus scattering is shown. In contrast to the result by Frank, Gammel and Watson, the real part of the potential remains strongly attractive; and the imaginary part is greatly reduced near the resonance energy. The photopion production cross section is calculated and compared with experiment. (auth)

29307 INNER REGION AND NONSTATIC EFFECTS OF NUCLEAR FORCES IN THE TRIPLET ODD STATE. Ryozo Tamagaki (Hokkaido Univ., Sapporo), Masanobu Wada, and Wataro Watari. Progr. Theoret. Phys. (Kyoto), 33: 55-70(Jan. 1965).

Nuclear forces at small distances and nonstatic effects are discussed in the triplet odd state by use of the potential model. It is investigated whether singular behavior such as the repulsive core is indispensable in this state. Analysis shows that the hard-core-like repulsion is not indispensable and that nonsingular potentials reproduce the solutions of the phase-shift analysis very well. The suppression of rapid increase of the $^3F_4$-phase shift at high energies is obtained by introducing the quadratic spin-orbit potentials modified so as to be effective in the coupled states. The behavior of the $^3P_0$-phase shift at E ~ 50 Mev is also discussed in connection with properties of potentials in the intermediate region. (auth)

29308 ON THE RENORMALIZATION OF THE AXIAL VECTOR β-DECAY COUPLING. Yoshiko Oi (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 33: 75-91(Jan. 1965).

The renormalization effect in beta-decay, $g_A/g_V = 1.25$, is calculated under the assumptions of the conservation of the vector current, the equality of the bare vector and the axial vector coupling constants. Based on the S-matrix theory, an approximate formula to calculate the ratio g_A/g_V is given, which requires only knowledge of experimental data on several partial-wave amplitudes of N-$\bar{N}$ scattering. The numerical calculation, however, is made by the use of N-$\bar{N}$ scattering amplitudes calculated from π, ρ, and ω meson exchange contributions. The result obtained is much the same as that obtained from the perturbation calculation. In connection with this problem the possible existence of an axial vector meson is discussed. (auth)

29309 ON THE PHONON-QUASIPARTICLE INTERACTIONS IN SPHERICAL ODD NUCLEI. Masatoshi Yamamura (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto), 33: 199-214(Feb. 1965).

A systematic method which permits derivation of the phonon-quasiparticle interactions in spherical odd nuclei from the original nuclear Hamiltonian is developed from the standpoint of the microscopic theory. The fundamental idea is an extension, to the spherical odd nuclei, of the method which had been proposed by Marumori, Tokunaga and the present author with the purpose of analyzing the "anharmonicity" of the collective oscillations in spherical even nuclei. In the conventional model of spherical odd nuclei, only one type of the interaction is assumed. According to this theory, however, the existence of various types of the interactions are found, some of which seem to have interesting physical meaning. (auth)

29310 REFORMULATION OF SENIORITY SCHEME WITH ISOSPIN. Munetake Ichimura (Tokyo Univ. and Nihon Univ., Tokyo). Progr. Theoret. Phys. (Kyoto), 33: 215-237(Feb. 1965).

In a previous paper, many-nucleon states in the shell model were characterized through the group C_2 used for an exact treatment of charge-independent pairing interaction. This scheme was proved to be equivalent to Flowers' seniority-reduced-isospin scheme. The matrix elements of the pair creation operator (a generator of the group C_2) are connected with the coefficients of fractional parentage (CFP) of the type $[j^{n-2}(\beta_1 vt T_1 \alpha J)j]^2(T = 1\ J = 0)TJ\,]j^n\,\beta vt\ T\alpha J]$ which play an essential role in seniority scheme. Then a simple method of calculation of the matrix elements of the pair operator is developed, and they are tabulated up to $\lambda_1 + \lambda_2 \leq 4$ (complete for up to $f_{\frac{7}{2}}$ shell). A recursion formula of CFP in seniority scheme is derived, which is more general than that of de-Shalit and Talmi. (auth)

29311 EXCITATION FUNCTIONS OF THE $^{35}Cl(p,\gamma)^{36}Ar$ AND $^{37}Cl(p,\gamma)^{38}Ar$ REACTIONS IN THE PROTON ENERGY REGION 800 kev–2050 kev. L. Simons, E. Spring, A. Fontell, I. Forsblom, P. Holmberg, and H. Jungner (Univ. of

Helsinki). Soc. Sci. Fennica, Commentationes Phys.-Math., 30: No. 6, 14p. (1965).

Chlorine was bombarded with protons in the energy range E_p = 800 to 2050 kev. The region 800 to 1800 kev was investigated both with targets of natural chlorine and with separated targets of ^{35}Cl and ^{37}Cl. Of the 160 resonances observed, 37 resonances were assigned to the $^{35}Cl(p,\gamma)^{36}Ar$, and 116 resonances to the $^{37}Cl(p,\gamma)^{38}Ar$ reaction. Seven resonances were unassigned. Targets of natural chlorine only were used in the region 1800 to 2050 kev. Of the 37 resonances found 19 were assigned to the reaction $^{37}Cl(p,\gamma)^{38}Ar$. (auth)

29312 ELASTIC SCATTERING OF 55 Mev PROTONS BY HEAVY NUCLEI. Hiromichi Kamitsubo and Hajime Ohnuma (Tokyo Univ.). Tech. Rept. ISSP, Ser. A, No. 111, 1-5(Apr. 1964).

Differentical cross sections for the elastic scattering of 55-Mev protons were measured systematically for La, Gd, Tb, Dy, Ho, Tm, Yb, Ta, W, Au, Bi, ^{147}Sm, ^{149}Sm, and ^{183}W in relation to the optical potential and the role of deformation. The average thickness of the targets corresponded to an energy loss of less than 300 kev for 55-Mev protons. Protons from the INS 160-cm fm cyclotron (the Univ. of Tokyo) were scattered in the scattering chamber and detected by NaI(Tl). The protons leaving the target nuclei with excitation less than 1 Mev were included in the "elastic peak." The results showed that the diffraction structure was strongly damped for the highly deformed nuclei. It is concluded that the angular distribution for Ho is that of the protons elastically scattered and that the damping of the diffraction structure is characteristic of the elastic scattering. The angular distribution for Dy is also due to the elastic scattering, and the angular distributions for other deformed nuclei are roughly the same. According to Satchler, the effects of deformation on the scattering should be depressed in even nuclei and in odd nuclei with $I = 1/2$. From this consideration the angular distributions by Gd, Dy, Yb and W containing even mass nuclides, whose abundances are 69.5, 56.2, 68.7, and 85.7%, should differ from those by Tm, and ^{183}W with ground states spin $1/2$. No marked difference was observed. Results showed that the damping of the diffraction structure changed gradually from ^{139}La to Gd, suggesting the shape of the optical potential has no sudden change at N = 88. (NSA of Japan)

29313 ABSOLUTE U-235 THERMAL-FISSION YIELDS OF Cs-137 AND STABLE Kr, Xe, Nd, AND Sm ISOTOPES. William J. Maeck, Robert M. Abernathy, and James E. Rein (Phillips Petroleum Co., Idaho Falls, Idaho). Trans. Am. Nucl. Soc., 8: 10-11(May 1965).

29314 THE DIRECT YIELD OF Xe-135 IN THE FISSION OF U-233, U-235, Pu-239, AND Pu-241. C. B. Bigham, A. Okazaki, and W. H. Walker (Atomic Energy of Canada Ltd., Chalk River, Ont.). Trans. Am. Nucl. Soc., 8: 11(May 1965).

29315 THE DECAY OF N-16. S. A. Scott (Technion–Israel Inst. of Tech., Haifa) and A. Notea. Trans. Am. Nucl. Soc., 8: 71(May 1965).

29316 EXTERNAL BREMSSTRAHLUNG FROM PHOSPHORUS-32 BETAS. Vincent Truscello (The Martin Co., Baltimore) and Joseph Silverman. Trans. Am. Nucl. Soc., 8: 76-7(May 1965).

29317 HALF-LIFE OF Cs-137. R. E. Lewis, R. E. McHenry, and T. A. Butler (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 79-80(May 1965).

29318 INTERFERENCE BY (n,p) AND/OR (n,ALPHA) REACTIONS TO (n,GAMMA) REACTIONS USED IN ACTIVATION ANALYSIS. Henry H. Kramer, W. J. Hampton, and Werner H. Wahl (Union Carbide Corp., Tuxedo, N. Y.). Trans. Am. Nucl. Soc., 8: 83(May 1965).

29319 ANALYSIS OF (n,2n) CROSS SECTIONS FOR MEDIUM- AND HEAVY-MASS NUCLEI. S. Pearlstein (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 8: 206-7(May 1965).

29320 POISON WORTH OF GADOLINIUM WITH IRRADIATION. Patrick Lacy (Societe Rateau, France) and Pierre Descleve. Trans. Am. Nucl. Soc., 8: 210-11(May 1965).

29321 CROSS SECTIONS FOR REACTOR DESIGN. N. C. Francis (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Am. Nucl. Soc., 8: 214(May 1965).

29322 FAST-NEUTRON ELASTIC- AND INELASTIC-SCATTERING CROSS SECTIONS. Herbert Goldstein (Columbia Univ., New York). Trans. Am. Nucl. Soc., 8: 214-15(May 1965).

29323 CALCULATION OF (n,p) CROSS SECTIONS. C. R. Lubitz, C. L. Dunford, and N. C. Francis (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Am. Nucl. Soc., 8: 215-16(May 1965).

29324 RESONANCE CROSS SECTIONS. L. W. Nordheim (General Atomic, San Diego, Calif.). Trans. Am. Nucl. Soc., 8: 216(May 1965).

29325 MULTILEVEL FORMULAE. D. R. Harris (Westinghouse Electric Corp., West Mifflin, Pa.). Trans. Am. Nucl. Soc., 8: 216-17(May 1965).

29326 THE NEUTRON CROSS SECTIONS OF THE VERY HEAVY NUCLIDES. R. E. Cote (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 217-18(May 1965).

29327 LINE SHAPES OF SLOW NEUTRON RESONANCES. Vance L. Sailor (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 8: 218-19(May 1965).

29328 THERMAL-NEUTRON CROSS SECTIONS OF FISSILE ISOTOPES. John R. Stehn (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 8: 219-20 (May 1965).

29329 MEASUREMENT OF FAST-FISSION RATIOS IN NATURAL URANIUM. C. B. Bigham (Atomic Energy of Canada Ltd., Chalk River, Ont.). Trans. Am. Nucl. Soc., 8: 268-9(May 1965).

29330 MEASUREMENT OF THE RATIO OF GAMMA ACTIVITY PER UNIT FISSION IN URANIUM-235 TO URANIUM-238. R. E. Horne, J. C. Montfort, E. M. Page, and D. A. Daavettila (Atomic Power Development Associates, Inc., Detroit). Trans. Am. Nucl. Soc., 8: 269-70(May 1965).

29331 THE USE OF INEXPENSIVE NUCLEAR MODELS FOR HIGH SCHOOL STUDENTS. T. G. Williamson and W. Reed Johnson (Univ. of Virginia, Charlottesville). Trans. Am. Nucl. Soc., 8: 279(May 1965).

29332 MEASUREMENT OF THE DOPPLER COEFFICIENT OF THORIUM OXIDE RODS TO 1550°C. F. C. Schoenig, K. S. Quisenberry, D. P. Stricos, and H. Bernatowicz (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Am. Nucl. Soc., 8: 284(May 1965).

29333 EFFECTIVE RESONANCE INTEGRALS OF SEPARATED TUNGSTEN ISOTOPES. Donald Shook and Donald Bogart (Lewis Research Center, Cleveland). Trans. Am. Nucl. Soc., 8: 284-5(May 1965).

29334 A WIDE-RANGE STUDY OF THE EFFECTIVE RESONANCE INTEGRAL AND DOPPLER EFFECT IN Au-197. L. S. Beller and H. Farrar, IV (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 8: 285-6(May 1965).

29335 A METHOD OF CALCULATING MUTUAL SHIELDING BETWEEN RESONANCES OF DIFFERENT NUCLIDES. P. H. Kier (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 286-7(May 1965).

29336 INVESTIGATION OF THE FLUX-RECOVERY ASSUMPTION IN RESONANCE COMPUTATIONS. C. A. Stevens and G. D. Joanou (General Atomic, San Diego, Calif.). Trans. Am. Nucl. Soc., 8: 287-8(May 1965).

29337 RESONANCE INTEGRALS IN SLAB LATTICES USING VARIOUS ESCAPE PROBABILITIES. E. M. Pennington (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 288-9(May 1965).

29338 REACTIVITY MEASUREMENTS TO DETERMINE RARE-EARTH RESONANCE ABSORPTION INTEGRALS. J. J. Scoville and J. W. Rogers (Phillips Petroleum Co., Idaho Falls, Idaho). Trans. Am. Nucl. Soc., 8: 290(May 1965).

29339 RESONANCE ACTIVATION RATES IN DIFFERENT NEUTRON SPECTRA. J. G. Carver (General Electric Co., Pleasanton, Calif.). Trans. Am. Nucl. Soc., 8: 300-1(May 1965).

29340 K CAPTURE BY ^{104}Rh (42.8 SEC). L. Frevert, R. Schoeneberg, and A. Flammersfeld (Universitat, Gottingen, Ger.). Z. Physik, 185: 217-20(1965). (In German)

The ratio of electron capture of β^--decay for ^{104}Rh was determined to be $(4.5 \pm 1) \times 10^{-3}$ for the first time using scintillation spectrometers in an anticoincidence technique. (auth)

29341 ON THE DETERMINATION OF THE SPIN CUTOFF COEFFICIENT σ. O. W. B. Schult, B. P. K. Maier, U. Gruber, and R. Koch (Technische Hochschule, Munich and Atomenergikomissiones Forsogsanlage, Risø, Roskilde, Denmark). Z. Physik, 185: 295-300(1965). (In German)

A value of $\sigma = 3.5 \pm 1$ is obtained for the spin cut off coefficient in the Fermi gas level density formula from a comparison of calculated and experimental (n,γ)-intensities feeding the observed levels of deformed nuclei in the rare earths region. The model used for the computations is tested at two nuclei with compound states of low spin (I_c = $\frac{1}{2}$) and high spin ($I_c = \frac{13}{2}$ or $\frac{15}{2}$). The calculations can help to determine spins of nuclear levels in some cases. (auth)

29342 SCATTERING OF SLOW NEUTRONS IN He NEAR λ CURVE. V. L. Pokrovskii and G. I. Surdutovich (Inst. of Semiconductors, Academy of Sciences, Siberian SSR). Zh. Eksperim. i Teor. Fiz., 48: 1097-1110(Apr. 1965). (In Russian)

The scattering cross section for slow neutrons in He near the λ-curve is found by applying phase transition theory. The results obtained permit one to experimentally verify the main theoretical prediction regarding the form of the fluctuation spectrum $\epsilon = Aq^4$. Some general relations are obtained between thermodynamical quantities and the neutron scattering cross section. (auth)

29343 EFFECT OF INTERACTION BETWEEN NEUTRONS AND NUCLEI ON THE PARAMAGNETIC RESONANCE WIDTH IN A NEUTRON BEAM. V. G. Baryshevskii, V. L. Lyuboshits, and M. I. Podgoretskii (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 48: 1146-9(Apr. 1965). (In Russian)

Paramagnetic resonance in a neutron beam is analyzed by taking into account the interaction between the neutrons and target nuclei. The effect of polarization of the target on the width of the resonance line is investigated. It is shown that the width of the resonance line is determined by incoherent processes resulting in escape of neutrons from the beam. The results are analyzed under the assumption that paramagnetic resonance may be regarded as a photon absorption and emission process during transitions between finite width levels. (auth)

29344 NUCLIDIC MASSES. PROCEEDINGS OF THE SECOND INTERNATIONAL CONFERENCE ON NUCLIDIC MASSES, VIENNA, AUSTRIA, JULY 15-19, 1963. Walter H. Johnson, Jr., ed. Vienna-New York, Springer-Verlag, 1964. 480p. $29.00. (CONF-52)

Separate abstracts were prepared for 30 of the 37 papers included. Six other papers were previously abstracted for NSA 17: 31406, 32998, 33950, 36639; 18: 1057; and 19: 14607. The remaining paper discusses the interest of the International Union of Pure and Applied Chemistry in the values of the fundamental constants. (D.C.W.)

For abstracts of individual papers see: 28336, 28736, 28929, 28930, 28973, 29011, 29110, 29345, 29346, 29347, 29348, 29349, 29350, 29351, 29352, 29353, 29354, 29355, 29356, 29357, 29358, 29359, 29360, 29361, 29362, 29363, 29364, 29365, 29366, and 29367.

29345 MASS LAWS AND NUCLEOSYNTHESIS. P. A. Seeger (California Inst. of Tech., Pasadena). p.1-10 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

The formation of elements is discussed, with particular consideration of the mass law. The requirements for a mass law are outlined, together with calculations of the γ-process path and γ-process abundances. It is shown that there is ample experimental evidence by which to test semi-empirical mass laws. (D.C.W.)

29346 SEMI-EMPIRICAL ANALYSIS OF NUCLEAR MASSES. Nissan Zeldes (Hebrew Univ., Jerusalem). p.11-37 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

The empirical features of the nuclear mass surface are briefly reviewed; and theoretical interpretations are discussed, starting with mass formulas based on the shell model. Corrections to mass formulas based on the liquid drop model are also considered. (D.C.W.)

29347 EMPIRICAL SEPARATION ENERGIES AND THE BCS PAIRING THEORY. M. Beiner, K. Bleuler, P. Huguenin, and R. de Tourreil (Universitat, Bonn). p.38-41 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

Separation energies as determined from nuclide masses exhibit the characteristic features of shell structure if plotted in a suitable three-dimensional scheme. This experimental behavior was checked numerically by shell-model calculations. It was found that rather good agreement was obtained if the independent particle levels of shell structure were corrected using the BCS pairing theory. (D.C.W.)

29348 A NEW NUCLIDIC MASS LAW. H. Kuemmel (Oklahoma State Univ., Stillwater), J. Mattauch, W. Thiele, and A. H. Wapstra. p.42-57 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

A mass formula is described in which features from the liquid-drop and shell models are included, together with the deformation energy and the pairing energy. The determination of the parameters of the formula is outlined, and some preliminary results are presented. (D.C.W.)

29349 SEMI-EMPIRICAL INTERPRETATION OF NUCLEAR MASSES AND DEFORMATIONS. Wladyslaw J. Swiatecki (Univ. of California, Berkeley). p.58-66 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

A semi-empirical mass formula is described in which the dependence of the mass of a nucleus on deformation is given by a liquid-drop expression corrected by a shell term, which disappears for large distortions. Saddle-point masses, the electrostatic energy of diffuse charge distributions, and the Wigner term $|N-Z|$ are discussed in relation to the interpretation of nuclear masses. (D.C.W.)

29350 STATUS REPORT ON ATOMIC MASSES. Aaldert Hendrik Wapstra (Instituut voor Kernphysisch Onderzoek, Amsterdam) and Josef H. E. Mattauch. p.74-81 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

Some improvements in the accuracy of determinations of atomic masses and the neutron mass are discussed, with emphasis on the precision of mass spectroscopic determinations. Some advances in the determination of decay and reaction energies are also considered, as well as the adjustment of mass tables on the basis of the more accurate data. (D.C.W.)

29351 SOME STATISTICAL PROBLEMS IN THE COMPUTATION OF NUCLIDIC MASS FORMULAE. Ernst Breitenberger (Univ. of South Carolina, Columbia). p.91-103 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

Some statistical problems in the calculation of mass formulas are outlined. (D.C.W.)

29352 THE PROTON GYROMAGNETIC RATIO AS A NUCLEAR STANDARD. Horst A. Capptuller (Physikalisch-Technische Bundesanstalt, Brunswick). p.105-12 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

Experimental methods for determining the proton gyromagnetic ratio are reviewed; experiment-results are included. The accuracy of the experimental methods is briefly discussed, and the average value obtained by an international group for protons in pure water is given. (D.C.W.)

29353 SYSTEMATICS OF SINGLE-PARTICLE LEVELS. Bernard L. Cohen (Univ. of Pittsburgh). p.187-92 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

The determination of single-particle (shell-model) levels by analysis of (p,d), (d,p), and (d,t) reactions is briefly discussed, and the available data for all closed neutron shell nuclei are given on a plot of neutron binding energy vs mass number. The data for Ca and Zr are considered in some detail. The variation of binding energy with mass number, self-binding effects, interactions of nucleons with the same angular momentum, and spacings between shells are noted; spin-orbit splittings are included. (D.C.W.)

29354 SEPARATION ENERGIES OF NUCLEON PAIRS. H. T. Tu and K. Way (National Research Council. Washington, D. C.). p.193-208 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

The separation energies of neutron and proton pairs in even-N and even-Z nuclei, respectively, were plotted as functions of N and Z to investigate the implications for nuclear structure of the data on nuclear masses. (D.C.W.)

29355 NUCLIDIC MASSES AND STRUCTURE OF NUCLEI. V. A. Kravtsov (Kalinin Polytechnical Inst., Leningrad). p.215-20 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

The status of determinations of nuclidic masses is indicated, and some recommendations for future research are made, particularly the measurement of reaction energies. Some conclusions on the structure of rare-earth nuclides are included. (D.C.W.)

29356 ENERGIES OF NATURAL ALPHA RADIATORS. A. Rytz (Bureau International des Poids et Mesures, Sèvres, France). p.221-8 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

A review of some measurements of particle energies for alpha emitters is presented. Comparison with other results is briefly considered, together with calibration standards. (D.C.W.)

29357 THE ENERGY OF POLONIUM ALPHA PARTICLES AS DETERMINED BY DIFFERENT METHODS. Cornelius P. Browne (Univ. of Notre Dame, Ind.). p.229-40 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

The best value of the energy of alpha particles from ^{210}Po is discussed with consideration of the different measurement techniques. A series of measurements and a calculation of the displacement induced in the ^{7}Li(p,n)^{7}Be threshold by using an H_2^+ beam rather than an H^+ beam are summarized. (D.C.W.)

29358 NUCLEAR RESONANCE ENERGIES. H. H. Staub (Universität, Zurich). p.257-60 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

A brief survey on the determination of resonance energies is presented with consideration of experimental methods and equipment and with emphasis on improvements in accuracy. The results of some recent measurements at various laboratories are included. (D.C.W.)

29359 RECOMMENDED VALUES OF CALIBRATION ENERGIES. Jerry B. Marion (Univ. of Maryland, College Park). p.279-88 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

The results of measurements of the ^{27}Al(p,γ)^{28}Si resonance energy, the ^{7}Li(p,n)^{7}Be threshold energy, threshold energies for six (p,n) reactions with thresholds between 3.2 and 9.6 Mev, and energies of helium-ion resonances and thresholds are summarized. Recommended values are included, and the analysis of the data is discussed. (D.C.W.)

29360 Q-VALUE MEASUREMENTS AT M.I.T. A. Sperduto and W. W. Buechner (Massachusetts Inst. of Tech., Cambridge). p.289-304 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

A review of Q-value measurements at MIT is presented. The magnetic spectrographs used are described, and the ground-state reaction Q-values measured since 1947 are tabulated. (D.C.W.)

29361 NUCLEAR REACTION MEASUREMENTS AT THE NATIONAL UNIVERSITY OF MEXICO. M. Mazari, A. Jaidar, G. Lopez, A. Tejera, J. Careaga, R. Dominguez, and F. Alba (Universidad Nacional Autónoma de México, Mexico City). p.305-23 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

A survey of the Q-value measurement program at the National University of Mexico is presented. A set of remeasurements of Q-values presented at the First International Conference on Nuclidic Masses is covered, and Q-values for (d,α), (d,p), and (p,α) reactions on gaseous nuclei embedded in metal and for reactions of 1.51-Mev ^{3}He particles are included. A toroidal multiple-gap broad-range magnetic spectrograph now under construction is described. (D.C.W.)

29362 Q-VALUE MEASUREMENTS AT THE UNIVERSITY OF PITTSBURGH. Roshan K. Patell and Bernard L. Cohen (Univ. of Pittsburgh). p.324-8 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

Neutron binding energies are being determined by measuring Q-values for (d,p) and (d,t) reactions using 15-Mev deuteron beams. The sources of error in the measurements are outlined, and preliminary binding energies for isotopes from ^{91}Zr to ^{209}Bi are included. (D.C.W.)

29363 THE RELATIVE MASSES OF SOME URANIUM ISOTOPES DETERMINED FROM NUCLEAR REACTION STUDIES. R. Middleton and H. Marchant (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). p.329-40 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

The preliminary results of an investigation of the ^{238}U(d,p)^{239}U, ^{238}U(p,d)^{237}U, ^{238}U(t,p)^{240}U, ^{236}U(t,p)^{238}U, ^{235}U(t,p)^{237}U, and ^{235}U(d,p)^{236}U are summarized. Angular distributions and energy spectra were measured, and Q-values were determined. Energy levels and transitions were also studied, and the relative masses of the isotopes were determined. (D.C.W.)

29364 Q-VALUES AS MEASURED THROUGH RESONANCE ENERGIES. H. H. Staub (Universität, Zurich). p.353-6 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

The bases for the determination of the Q-values of reactions from measurements of resonance energies are outlined, and a determination of the Q-value for the ^{27}Al(p,α)^{24}Mg reaction is summarized, including the results. The mass difference of ^{27}Al and ^{24}Mg is also included. (D.C.W.)

29365 SOME ATOMIC MASSES IN THE REGION FROM GALLIUM THROUGH MOLYBDENUM. R. R. Ries, R. A. Damerow, and W. H. Johnson (Univ. of Minnesota, Minneapolis). p.357-74 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

The reconstructed 16-in. double-focusing mass spectrometer at the University of Minnesota was used to measure a number of mass doublets in the region from Ga through Xe. Some of the atomic masses of stable isotopes between A = 69 and 100 are presented and are compared with other mass spectroscopic results and nuclear reaction results. A partial mass table of radioactive atoms was calculated for this region by combining these masses with available disintegration energies. The mass values were used to study the systematics of the nucleon binding energies around neutron shell closure at N = 50, as well as the proposed sub-shell at N = 40 and Z = 40. (D.C.W.)

29366 RECENT MASS VALUES OBTAINED AT McMASTER UNIVERSITY. R. C. Barber, R. L. Bishop, L. A. Cambey, H. E. Duckworth, J. D. Macdougall, W. McLatchie, J. H. Ormrod, and P. van Rookhuyzen (McMaster Univ., Hamilton, Ont.). p.393-414 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

The mass spectrometer used in measurements at McMaster University is described, and the mass differences obtained in measurements on mass doublets involving Cd,

Ge, Sb, Hg, Te, Sn, Mo, Zr, Se, Ti, and Zn isotopes are discussed and compared with existing data. The double neutron separation energies between the 50- and 82-neutron shells were also studied. The 56-neutron effect in ^{96}Zr was confirmed, and a smaller 56-neutron effect in ^{98}Mo was observed. No evidence for other sub-shells was obtained. (D.C.W.)

29367 NUCLIDIC MASSES AND BINDING ENERGIES OF NUCLEI FROM SAMARIUM TO LUTETIUM. R. A. Demirkhanov, V. V. Dorokhov, and M. I. Dzkuya (Inst. of Technical Physics, Georgian Academy of Sciences, Sukhumi, USSR). p.430-64 of "Nuclidic Masses." Vienna-New York, Springer-Verlag, 1964.

The masses of 41 stable isotopes from Sa to Lu were calculated on the basis of measurements on 140 mass doublets. The masses and binding energies of 64 radioisotopes were calculated on the basis of the masses of the stable isotopes. The results are tabulated, and the systematics of the binding energy are discussed. (D.C.W.)

29368 LEVEL DENSITIES IN LIGHTER NUCLEI. A. Gilbert (Columbia Univ., New York and Goddard Space Flight Center, New York), F. S. Chen, and A. G. W. Cameron. 27p. (CONF-758-19)

From American Physical Society Meeting, New York, Jan. 1965.

There has been discussion in the literature as to whether the cumulative number of levels in light nuclei varies more nearly as exp const. $E^{0.5}$, or exp const. E, where E is the excitation energy. This question is studied. It is found that if one constructs "step-diagrams" by plotting the cumulative number versus the energy, either formula represents the data about as well as the other. However, additional consideration of levels counted above neutron and photon binding energies, shows that exp const. $E^{0.5}$ fails badly to represent the data, whereas exp const. E continues to give good fits. In either case E may be measured above an arbitrary ground state energy E_0. If the satisfactory formula is written in the form exp $(E - E_0)/T$, then it is found that the dependence of the slope on mass number may be expressed in approximately the form $T^{-1} = 0.0165$ A Mev^{-1}, but there are significant deviations from this relation apparently related to shell structure. The intercepts E_0 are quite variable, but are roughly clustered according to the oddness or evenness of the neutron and proton numbers of the nucleus. (auth)

29369 CHANNEL EFFECTS IN THE KINETIC ENERGY OF FRAGMENTS OF FISSION INDUCED BY LOW ENERGY RESONANCE NEUTRONS. M. S. Moore and L. G. Miller (Phillips Petroleum Co., Idaho Falls, Idaho). Vienna, International Atomic Energy Agency, 1965, Preprint No. SM-60/10, 24p. (CONF-650301-17)

From Symposium on the Physics and Chemistry of Fission, Salzburg, Austria.

Recently, Blyumkina noted the existence of fission channel effects in the total kinetic energy of fragments of fission induced by s- and p-wave neutrons. Effects of this nature can also be expected in the variation of the fragment kinetic energies from resonance to resonance in low energy (s-wave) neutron-induced fission. A fission fragment detector whose efficiency is dependent on the kinetic energy of the fragments was used in the study of the slow-neutron fission of ^{235}U. Comparing the counting rate of this detector with a conventional fission detector, whose efficiency is independent of the fragment kinetic energy, shows that there exists a variation in the kinetic energy of certain fragments with neutron energy in the neutron energy region from 0.025 to 1 ev. In order to determine the response of the kinetic-energy-sensitive detector, it was necessary to measure the range-energy relations of fission fragments in various media, including noble gases and metallic foils. It was estimated from these data that the variation in the fragment kinetic energy release is ~ 500 kev, for those fission events which give the lightest and most energetic of the heavy fragments. The variation in fragment kinetic energy is strongly asymmetric about the 0.28-ev resonance in ^{235}U and suggests that the fragment kinetic energy sensitively reflects the presence of interference effects among resonances in fission. A multilevel-multichannel analysis of the data was made, based on the parameters of Vogt and under the assumption that different fission channels lead to different configurations at scission, such that the kinetic energy release is also different. Previously a major objection to multilevel-multichannel analysis in fission has been that the parameters obtained are not unique. However, the possibility of observing partial fission cross sections (fission occurring by way of one channel only) removes one of the ambiguities inherent in the multilevel approach. Studies of this type can not only be expected to give information on the nature of the constraints which exist during the transition from the saddle point to the scission point in the fission process, but may also be of interest in inferring the existence of amall variations from resonance to resonance in $\bar{\nu}$, the average number of neutrons emitted per fission. (auth)

29370 MEASUREMENT OF ABSOLUTE CROSS SECTIONS OF FISSION INDUCED BY 156 Mev PROTONS, USING MICA AS A FISSION FRAGMENT DETECTOR. M. Maurette and C. Stephan (Universite de Paris, Orsay, France). Vienna, International Atomic Energy Agency, 1965, Preprint No. SM-60/64, 9p. (CONF-650301-27)

From Symposium on the Physics and Chemistry of Fission, Salzburg, Austria.

The fission of elements of medium Z induced by 156-Mev protons is difficult to demonstrate, due to the particularly small cross section of the reaction. The detection of fission fragments by means of sheets of mica seemed to be a technique well suited to this type of experiment. And, in the sheets of synthetic mica which were used, it was only the fission fragments which left microscopically identifiable traces. Moreover, these samples contain very few impurities likely to undergo fission, so practically no parasitic traces are observed. The targets consisted of metals of not less than 99.999% purity. The absolute cross sections of fission induced by 156-Mev protons in the case of lanthanum (5 μb) and praseodymium (6 μb) were determined, and those of cadmium, indium, tin and antimony (≤0.1 μb) were estimated. The sheets of mica were placed on each side of the metal sheet. The kinetics of the reaction explain why more traces were found on the mica sheets placed on the front face. As thick targets were used to take account of self-absorption, in the case of uranium and gold the ratio of yields between a thin target and a thick target was determined and extrapolated to the other elements. Checks were made by comparing the absolute cross sections for fission (induced by 156-Mev protons) in uranium, bismuth, gold and tantalum, as obtained by this method, with those obtained by counters at this energy. The observed agreement was very good. (auth)

29371 INDIRECT DETERMINATION OF HALF-LIVES OF SHORT-LIVED FISSION GASES USING A GAS FLOW METHOD. P. Patzelt and G. Herrmann (Universitat, Mainz). Vienna, International Atomic Energy Agency, 1965, Preprint No. SM-60/60, 13p. (CONF-650301-26)

From Symposium on the Physics and Chemistry of Fission, Salzburg, Austria.

Since the investigation of charge distribution in nuclear fission requires the determination of primary yields of individual fission products, which in most cases are either short-lived themselves or grow from short-lived precursors, very rapid and effective separations of neighboring members of a fission chain have to be carried out. Making use of the extremely high emanating power of certain uranium compounds, separations most easily are performed for the fission gases in more than a dozen of fission-product chains. Yield calculations as well as the effective emanating power of thick target layers, however, may considerably be influenced by the half-life data of the gases. Therefore, the half lives of the krypton and xenon isotopes ^{89}Kr–^{93}Kr and ^{137}Xe–^{143}Xe were determined with great precision by using a rate of flow method in connection with an improved charged-electrode technique. Measurements were made via the active deposit of long-lived decay products on the electrodes. Flow rate, irradiation time, cooling period and counting arrangements were chosen in such a way that

measurements of individual daughter products became strongly favored. In some cases, for reasons of selectivity, radiochemical separations proved to be indispensable. The half lives were obtained by extrapolating the appropriate beta decay curves or decay curves of gamma peaks. The data listed are average values of a number of runs, resulting from a $w_i \sim 1/\sigma^2$ weighting procedure. All calculations have been done at the computer center of Mainz University. (auth)

29372 ENERGY DEPENDENCE OF $\bar{\nu}$ IN NEUTRON INDUCED FISSION OF U^{235} AND Th^{232} AND IN PHOTOFISSION OF U^{238}. H. Conde and M. Holmberg (Forsvarets Furskningsanstalt, Stockholm). Vienna, International Atomic Energy Agency, 1965, Preprint No. SM-60/46, 12p. (CONF-650301-25)

From Symposium on the Physics and Chemistry of Fission, Salzburg, Austria.

The average number of prompt neutrons ($\bar{\nu}$) emitted in the neutron-induced fission of ^{235}U and ^{232}Th and in the photofission of ^{238}U was measured with a large liquid scintillator as the fission neutron detector. The measurements were made relative to $\bar{\nu}$ for the spontaneous fission of ^{252}Cf. The $\bar{\nu}$-values of ^{235}U were measured at some different incident energies between 30 kev and 15 Mev, and the results are in agreement with measurements by Moat and Hopkins and Diven. The measurements of ^{232}Th were made for several incident neutron energies from the fission threshold at about 1.4 Mev to 15 Mev. Emphasis was concentrated on the energy region near the fission threshold where the fission cross section and the fragment angular distribution show strong variations with neutron energy. The measurements indicate that the energy dependence of $\bar{\nu}$ in this region may be non-linear. A measurement of $\bar{\nu}$ in the photofission of ^{238}U at a gamma energy of 7 Mev was made. The result is not in agreement with measurements by Prokohorova and Lazareva. The spontaneous fission of ^{240}Pu and the thermal-neutron-induced fission of ^{239}Pu give a difference in $\bar{\nu}$ corresponding to 0.10 neutrons/Mev. The result of the present investigation combined with the $\bar{\nu}$-value for the spontaneous fission of ^{238}U gives 0.10 ± 0.02 in agreement with the data obtained for the compound nucleus of ^{240}Pu. (auth)

29373 RANGE AND RANGE-DISPERSION OF SOME FISSION PRODUCTS FORMED BY THE $Pu^{239}(n_{th},f)$ REACTION. H. Muenzel, M. Hollstein, and T. Ishimori (Kernforschungszentrum, Karlsruhe, Ger.). Vienna, International Atomic Energy Agency, 1965, Preprint No. SM-60/41, 15p. (CONF-650301-24)

From Symposium on the Physics and Chemistry of Fission, Salzburg, Austria.

The range of some ^{239}Pu fission products ($83 \leq A \leq 143$) in aluminium was determined by the thick target/thick catcher method, and from this their kinetic energy was calculated. A ^{239}Pu–Al–alloy was used as the target material. An analysis of the results based upon the Whetstone Model indicates that both ^{239}Pu and ^{235}U undergo practically the same fission mechanism with thermal neutrons. In this analysis the ranges measured in air by Katcoff also were used after a transformation to ranges in aluminium. Furthermore the differential distribution of the "cumulative" ranges of ^{140}Ba and ^{127}Sb were determined by means of the Al-stripping method. The half-widths of the distribution for the two masses are 20.2 ± 1.0 and 23.1 ± 1.7 %, respectively, and correspond to respective mean ranges of 3.00 ± 0.10 and 3.6 ± 0.2 mg Al/cm^2. The former values are nearly a factor of two greater than those determined with gaseous stopping materials. A background found in the low-range side of the distribution could not be explained, but some possibilities for its origin were eliminated experimentally. Another result of the experiments showed that the Al-stripping method gives broadened distribution curves for elements more electropositive than aluminium. According to the experiments of Niday as well as Brown and Oliver the range of shielded nuclides is unexpectedly small. To examine this effect, the "fragment"-ranges of ^{139}Ba and ^{139}Cs in aluminium were determined by the thick target/thick catcher method. These ranges are also smaller than the mean range for the isobaric chain 139. This deficiency increases with increasing value of $Z - Z_p$. Therefore, even the range distribution arising from the fission process (the half-width of this distribution has been estimated by Good and Wollan and by Petrzhak to be 5 to 6% for an isobaric chain in the heavy mass region) is still complex. (auth)

29374 FISSION YIELDS IN THE IODINE REGION. G. Rudstam (CERN, Geneva). Vienna, International Atomic Energy Agency, 1965, Preprint No. SM-60/65, 9p. (CONF-650301-28)

From Symposium on the Physics and Chemistry of Fission, Salzburg, Austria.

The independent yields of all iodine isotopes from ^{118}I to ^{134}I except ^{122}I (short-lived), ^{127}I (stable) and ^{129}I (long-lived) resulting from irradiation of natural uranium with 590-Mev and 19-Bev protons were measured. In addition, cross sections (mostly cumulative) of many xenon and tellurium isotopes were obtained. In the experiments extensive use was made of an electromagnetic isotope separator, constructed at CERN for nuclear reaction studies, by which the iodine (or tellurium) isotopes were separated from samples chemically isolated from the irradiated targets. In the study of xenon isotopes the uranium target was heated in a small oven connected to the separator via a cold trap to stop unwanted activities. After the separation, the activity of the samples was measured by counting methods. In certain cases (^{118}I, ^{119}I, ^{120}I, ^{121}I, ^{118}Xe, ^{119}Xe, ^{120}Xe, ^{121}Xe), spectroscopic investigations were performed in order to provide information for the conversion of the counting data to absolute counting rates needed for the determination of the fission yields. The experiments show a significant shift in the isotopic cross section distribution when comparing the 19-Bev results with those obtained at the lower energy. The yields far out at the neutron-deficient wing increase considerably, whereas the other part of the distribution is depressed. A comparison with spallation data indicates that the neutron-deficient part of the distribution might result from the spallation of uranium. Spallation gives negligible yields in the iodine region at 590 Mev, but at 19 Bev these cross sections are expected to be much larger. The competition with spallation decreases the probability for fission and consequently the yields of the fission products will decrease. (auth)

29375 ANGULAR DISTRIBUTION OF U^{238} FISSION FRAGMENTS PRODUCED BY MONO-ENERGETIC GAMMA RAYS. H. G. de Carvalho (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro), A. G. da Silva, R. N. Alves, and W. Woelfli. Vienna, International Atomic Energy Agency, 1965, Preprint No. SM-60/78, 12p. (CONF-650301-29)

From Symposium on the Physics and Chemistry of Fission, Salzburg, Austria.

The angular distribution of ^{238}U fission fragments was measured using mica plates as detectors. The fission process was induced by monoenergetic gamma rays of the following discrete energies: 6.07, 6.75, 6.80, 7.38, 7.64, 7.73 and 9.00 Mev. The sources of mono-energetic gamma rays were (n,γ) reactions on seven different target elements in the Saphir reactor of the E.T.H. in Zurich. The gamma line absolute intensities were of the order of 10^6 photons/cm^2 sec. The neutron and gamma backgrounds were estimated with a Bi target. Uranium oxide films of about 0.2 mg/cm^2 thickness were prepared by spreading a solution of uranyl nitrate in alcohol-ether-collodium on the surface of mica plates and heating to 500° in the oven. For thicker films, the process was repeated several times. The films were then covered with another mica plate and the sandwich was vacuum sealed in plastic (.2 mm thick) envelopes. This way the mica plates are pressed together by the external pressure and the pairing-off of fission fragments is made more probable. The mica plates had some "fissile" background tracks from the spontaneous fission of ^{238}U (or possibly ^{232}Th) impurities in the mica. There had been some experimental evidence that heating the mica at 500° for a few hours causes "fading" of these "fissile" tracks. For this reason the cover plates were heated at 500° for about two hours, but to make sure no "fissile" tracks would be counted, the cover plates were etched in hydrofluoric

acid for 12 hr. Since there might occur some track losses at small "dip" angles due to the uranium oxide films and at large dip angles due to scanner losses, only tracks with dip angle between 15° and 75° were used in the calculations of the angular distributions. (auth)

29376 EMISSION OF LONG-RANGE ALPHA PARTICLES IN 3 Mev NEUTRON-INDUCED FISSION OF U^{235}. V. A. Hattangadi, T. Methasiri, D. M. Nadkarni, R. Ramanna, and P. N. Rama Rao (Atomic Energy Establishment, Trombay, India). Vienna, International Atomic Energy Agency, 1965, Preprint No. SM-60/71, 14p. (CONF-650301-30).

From Symposium on the Physics and Chemistry of Fission, Salzburg, Austria.

The energy and angular distributions of long-range alpha particles emitted in the fission of ^{235}U induced by 3-Mev neutrons were measured. The alpha particles were detected by solid-state detectors and the fission fragments were detected by a gas scintillation counter. The neutrons were produced by the $T(p,n)^3He$ reaction using a 5.5-Mev Van de Graaff accelerator. About 3000 fission events accompanied by the emission of high-energy alpha particle were recorded. The most probable energy of the alpha particles is between 15 and 16 Mev, and the energy distribution has a full width at half maximum of about 9 Mev, which is the same as observed in thermal neutron fission. The angular distribution of the long-range alpha particles with respect to the incident neutron direction was found to be forward-peaked, in agreement with previous work on alpha emission in 14-Mev neutron-induced fission of ^{238}U. At angles of 0° and 90° with respect to the incident neutron direction the alpha particles were detected with an angular spread of about ±25°. The anisotropy $[N_\alpha(0°)/N_\alpha(90°)]$ was found to be 1.320 ± 0.12. This value is in agreement with the anisotropy calculated on the basis of statistical evaporation of particles. The results of the present investigation are consistent with the hypothesis that the emission of long-range alpha particles in fission is an evaporation process. The implications of the results of this work and of other recent investigations on long-range alpha emission are discussed. (auth)

29377 A COMPOSITE NUCLEAR LEVEL DENSITY FORMULA WITH SHELL CORRECTIONS. A. Gilbert (Columbia Univ., New York and Goddard Space Flight Center, New York) and A. G. W. Cameron. 117p. (CONF-758-20).

From American Physical Society Meeting, New York, Jan. 1965.

At low excitation energies a "constant nuclear temperature" representation of nuclear level densities is used, and at high excitation energies the regular Fermi gas formula is adopted. A method is developed for determining the parameters of the Fermi gas formula, using both the pairing and the shell correction energies found by Cameron and Elkin for their semiempirical atomic mass formula in its exponential form. This procedure determines level densities at neutron binding energy excitations subject to an average factor error of 1.8. Methods are also developed for determining the parameters for the lower energy formula in such a way that it best fits the lower energy levels and joins smoothly to the Fermi gas formula. Correlations of the resulting parameters with shell and pairing effects are found. A composite prescription is given for calculating level densities in nuclei for which no experimental information is known. Tables give level density parameters for a wide variety of nuclei for which some experimental information is known. Some of the derivations of the Fermi gas formula in the literature were found to be slightly incorrect; new derivations are presented. 180 references. (auth)

29378 MASS AND CHARGE DISTRIBUTION IN LOW ENERGY FISSION. A. C. Wahl (Washington Univ., St. Louis). Vienna, International Atomic Energy Agency, 1965, Preprint No. Sm-60/22, 23p. (CONF-650301-19).

From Symposium on the Physics and Chemistry of Fission, Salzburg, Austria.

The charge and mass distributions in thermal-neutron fission of ^{235}U are discussed and compared with the corresponding distributions in other low-energy fission processes. Both binary and ternary fission are considered. Estimates of the charge distribution of primary (before neutron emission) fission fragments and of primary yields are presented. Thermal-neutron fission of ^{239}Pu and ^{233}U, spontaneous fission of ^{252}Cf and ^{240}Pu, 14-Mev neutron fission of ^{235}U and ^{238}U, 11-Mev proton fission of ^{226}Ra, and 22-Mev deuteron fission of ^{209}Bi are also discussed. (D.C.W.)

29379 PRIMARY DISTRIBUTIONS OF NUCLEAR CHARGE FOR FISSION FRAGMENT MASSES 132, 134, 136, AND 137 FROM THERMAL FISSION OF U^{235}. E. Koneony, H. Opower, H. Gunther, and H. Goebel (Technische Hochschule, Munich and Justus Liebig Universitat, Giessen, Ger.). Vienna, International Atomic Energy Agency, 1965, Preprint No. Sm-60/33, 19p. (CONF-650301-22).

From Symposium on the Physics and Chemistry of Fission, Salzburg, Austria.

Using a mass spectrometer, fission fragments from thermal fission of ^{235}U are exactly separated with respect to mass and kinetic energy within a time of 10^{-6} sec after fission. The separated fragments are caught in a beta-sensitive Ilford G 5 emulsion which is located in the focal plane of the spectrometer. Development of the irradiated emulsions is carried out, if possible, after a time long compared with the longest half-life of the regarded decay chain. Half-lives on the order of days or longer are not taken into account, but it can be corrected easily for them. After development of the emulsions all beta tracks emerging from the end of every fission fragment track can be seen under the microscope. The possibility of correlating every single beta track to a certain fission fragment track allows the evaluation of the number n(x) of fission fragments possessing x beta tracks thus giving not only the mean chain length but also the beta distribution. As the stable end product of each decay chain is known, this beta distribution is an exact image of the primary nuclear charge distribution. In the measurements done up to now, only beta particles emitted into the half solid angle formed by the emulsion plate were registered, but a simple statistical calculation allows to evaluate the desired 4π-distribution. By this method beta distributions at fixed kinetic energies near the mean kinetic energy of each fragment mass are given for the masses 132, 134, 136, and 137. For the lower masses 132 and 134 the neutron shell N = 82 proves to be responsible for the most probable primary charges near 50 and 52, respectively. For M = 136 and 137 the primary charge is about 53 and 53.2. Additional approximate corrections respective to conversion electrons (by omitting very short beta tracks corresponding to very low beta energies) and to delayed neutrons (for mass 137) prove not to be very heavy. Similar measurements carried out directly in 4π-geometry in order to avoid the statistical error arising from the transformation from 2π- to 4π-distribution, and for various kinetic energies as parameters are in preparation. (auth)

29380 TERNARY FISSION. M. L. Muga (Univ. of Florida, Gainesville). Vienna, International Atomic Energy Agency, 1965, Preprint No. Sm-60/73, 30p. (CONF-650301-33).

From Symposium on the Physics and Chemistry of Fission, Salzburg, Austria.

The fission process in which heavy nuclei fragment into three large charged particles were studied in the case of thermal neutron induced fission of ^{235}U and the spontaneous fission of ^{252}Cf. Using solid state detectors, a fast triple-coincidence system and a three-coincident-parameter analyzer, measurement of the three fission fragment energies is made parallel with the detection of each ternary fission event. Experimental evidence is presented which supports the existence of ternary fission by specifically excluding recoil phenomena and accidental events as contributions to the observed three-fold coincidence events. Mass-energy-angular correlations of ternary fission were determined and are summarized as follows. The total ki-

netic energy release in ternary fission appears to be slightly higher (by approximately 10 Mev) than that for binary fission. In the case of the spontaneous ternary fission of ^{252}Cf, the frequency of occurrence is observed to be greater than 2.2×10^{-6} ternary fission events per binary fission event. Tripartition of ^{252}Cf results preferentially in division into two medium mass particles (one of which has a mass number near 56) and one larger mass. In the case of thermal neutron induced fission of ^{235}U, the frequency of occurrence is observed to be greater than 1.2×10^{-8} ternary fission events per binary fission event. Ternary fission of $^{236*}U$ results in the formation of one light fragment (near mass 36) and two large fragments or, as in the case of ^{252}Cf, two medium fragments and one large one. These results indicate that axially asymmetric distortion modes are possible in the pre-scission configurations of the fissioning nucleus. A description is given of experiments designed to radiochemically detect the light fragment resulting from ternary fission. (auth)

29381 MASS AND CUMULATIVE YIELDS IN NEAR-SYMMETRIC FISSION OF U^{235} WITH THERMAL NEUTRONS. H. V. Weiss and N. E. Ballou (Naval Radiological Defense Lab., San Francisco). Vienna, International Atomic Energy Agency, 1965, Preprint No. SN-60/29, 17p. (CONF-650301-21)

From Symposium on the Physics and Chemistry of Fission, Salzburg, Austria.

Determinations of the fission yield of mass 121 and of cumulative yields of members of that decay chain were made as part of a study of symmetric and nearly symmetric fission of ^{235}U with thermal neutrons. Fast chemical separation methods were developed which permit isolation of selected fission product elements in 3 to 30 sec. The methods were applied to identification and characterization of new, short-lived radionuclides in addition to their use in studies of distribution of nuclear charge in fission. The cumulative fission yield of ^{121}Sn (27.5h) was measured to be $1.1 \pm 0.1 \times 10^{-2}\%$ as compared to the single literature value of $1.5 \times 10^{-2}\%$. Taking the cumulative yield of ^{121m}Sn (~25y) as $0.08 \times 10^{-2}\%$ and making the assumption that the independent fission yield of ^{121}Sb is negligible, a fission mass yield of $(1.2 \pm 0.1)\ 10^{-2}\%$ for mass chain 121 in thermal neutron fission of ^{235}U is obtained. Identification of ^{121}Cd was made. Its half-life and cumulative fission yield were determined to be 12.8 sec and $6.4 \pm 0.5 \times 10^{-3}\%$, respectively. If the nuclear charge distribution curve is gaussian and if a width parameter of 0.62 as given by Wahl is taken, the cumulative fission yield of ^{121}Cd leads to a value of 48.35 for the most probable nuclear charge (Z_p) for mass chain 121. This value of Z_p combined with published values for other mass chains more removed from symmetric fission indicates in a preliminary way that the Z_p function proceeds toward the point of symmetric fission by a gentle rather than an abrupt approach. Fast chemical separation techniques were developed which are based on sublimation of metal chelates, precipitation and metal reduction reactions. Isolation of indium in about 30 sec was accomplished by precipitation and sublimation of its acetylacetonate. With this procedure the cumulative fission yield of ^{121}In (3.1m) was determined to be $3.2 \times 10^{-2}\%$. Cadmium as an ammine complex was separated in 3 sec from hydroxide and oxalate precipitates of other chain members (indium and tin). Isolation of silver was accomplished in 3 sec by reduction of ionic silver by finely divided copper powder. With this procedure, no evidence for ^{121}Ag was seen; thus, its half-life is shorter than several sec or its fission yield is inordinately low. (auth)

29382 EXPERIMENTS WITH MASS SPECTROSCOPICALLY SEPARATED FISSION PRODUCT IONS. H. Ewald (Justus Liebig Universität, Giessen, Ger. and Technische Hochschule, Munich). Vienna, International Atomic Energy Agency, 1965, Preprint No. SM-60/38, 17p. (CONF-650301-23)

From Symposium on the Physics and Chemistry of Fission, Salzburg, Austria.

After a short description of the fission product mass spectrograph installed at the reactor at Garching (Munich), a survey is given of the experiments done with it. Exact distributions of ion charge numbers were obtained for particles having nearly their initial kinetic energies and for those which are slowed down more or less in thin foils. Also their multiple scattering in such foils was measured. The pulse height defects which are observed in counting fission particles with surface barrier counters were measured. In nuclear emulsions, the numbers of β-particle tracks emerging from the ends of the tracks of fission particles of definite mass numbers were counted. From the distributions of these numbers conclusions can be drawn on the distributions of the initial nuclear charges in the decay chains. In addition to this, the β decays of the particles of definite mass numbers are examined directly with a 4π-counter. The distributions of the initial kinetic energies of the particles of different mass numbers are also studied. The possibility is discussed of measuring in coincidence both particles of the fission processes travelling in opposite directions by the help of two such spectrographs. For the experiments on the interaction of fission particles with matter, the intensity of the spectrograph is sufficient in most cases. In the studies of the fission process and the β decays, often a much higher rate of separated particles would be desired. Therefore plans are performed for a second order focusing parabola spectrograph which when installed at a larger reactor will give us intensities larger by a factor of about 100 compared to the present one. (D.L.C.)

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Refer also to abstracts 28337, 29007, 29143, 29146, 29406, and 29466.

29383 (AD-606186) INSTABILITIES IN THE ELECTRON-HOLE PLASMAS IN SEMICONDUCTORS. Report No. 64-19. S. Kakihana (California Univ., Berkeley. Electronics Research Lab.). May 25, 1964. Contract Nonr-222(57). 176p. $5.00(CFSTI).

Studies of two types of instability in semiconductor electron-hole plasmas are reported. The helical instability, occurring in the simultaneous presence of axial electric and magnetic fields, and oscillator-type oscillations are considered; experimental work is described, verifying previous theories developed by Kadomotsev and Nedospasov, Glicksman, and Holter. Instability occurring in the absence of magnetic field is then discussed; in an electric field, perturbations in the plasma density are polarized and produce dipolar electric fields. The oscillation modes produced are found to resemble two-stream instabilities in plasma. It is shown that if there is a longitudinal spatial gradient in the steady-state plasma density, and if the electric field is sufficiently strong, there is a net energy transfer from the particle mode to the wave mode for waves propagating in an appropriate direction relative to the density gradient and the d-c field. An expression is derived predicting the dependence of threshold electric field on threshold injection level. (M.J.T.)

29384 (AD-607846) MAGNETOHYDRODYNAMICS IN A FIELD OF INTERMEDIATE STRENGTH. H. W. Wyld, Jr. (Space Technology Labs., Inc., Los Angeles, Calif.). Sept. 30, 1958. Contract AF04(647)-165. 19p. (GM-TR-0165-00486). $1.00(CFSTI)

A magnetohydrodynamic approximation is developed for magnetic fields strong enough so that the Larmor radii and periods of the electrons are negligible while those of the ions are not. Electrons are then bound to the field lines while the ions are chiefly influenced by electrostatic forces. This formalism is applied to the particular problem of stationary, large amplitude waves and solutions are given for the case where the Alfven velocity is small compared to light velocity. (auth)

29385 (AD-608794) GRAPHS OF ELECTRICAL PROPERTIES OF IONIZED MEDIA. C. P. Sonett (Ramo-

Wooldridge Corp., Los Angeles, Calif.). Aug. 30, 1957. Contract AF18(600)-1190. 24p. (GM-TM-190). $1.00 (CFSTI)

The computations are graphed based on the assumption that the damping constant is equal to the collision frequency, Z. All of the calculations are for an isotropic medium. (auth)

29386 (AD-610804) PLASMA OSCILLATIONS AND WAVES. PART I. O. E. H. Rydbeck (Pennsylvania State Univ., University Park. Ionosphere Research Lab.). Jan. 10, 1965. Contract AF19(628)-4014. 133p. (AFCRL-64-976). $4.00(CFSTI).

The wave propagation and oscillation properties of a one- or two-component plasma in the absence of a static magnetic field are discussed. It is assumed that the electrons behave as a continuous 'fluid' and the total wave field is split up into electromagnetic and plasma modes. It is shown that the total field can be described by three potentials, viz. one vector potential, and one scalar plasma potential. The gradient coupling between the electromagnetic and plasma modes is discussed and illuminated by a practical example. The plasma wave radiation from transient or moving point sources is discussed in detail, especially the properties of the Cherenkov-type plasma wave cone. The electron and ion velocity distribution is taken into account. The complex omega-values are analyzed and discussed as functions of the plasma wave number k. The limited validity range of the Landau damping dormula is demonstrated graphically. A discussion of higher order plasma modes is included. Finally the possibilities of obtaining growing waves in two-stream media are analyzed in some detail, for electron-electron as well as for ion-electron streams. (auth)

29387 (AD-611065) STUDY OF COLLISION PROCESSES IN GASEOUS PLASMAS. Annual Summary Report, October 1, 1963–October 1, 1964. H. J. Oskam (Minnesota Univ., Minneapolis. Dept. of Electrical Engineering). Contract Nonr 710(37). 9p. $1.00(CFSTI).

The studies were started in 1958 with the measurement of the time dependence of the number density of electrons in decaying plasmas and have been extended by studying the properties of ions, metastable atoms, etc. This investigation is directed towards the relation between the values of the mobility of positive ions as obtained from time-of-flight studies and those calculated from ambipolar diffusion coefficients measurements; the study of the mechanism of electron-positive ion and negative ion-positive ion recombination, combined with the measurement of the reaction rates involved; the production processes and properties of homonuclear and heteronuclear polyatomic ions; the study of the origin of light emitted by a decaying plasma; the study of the properties of metastable excited atoms. The equipment being used for the studies described has been designed and constructed with the goal of measuring simultaneously the properties of as many plasma constituents as possible. (auth)

29388 (ARL-65-73) LAMINAR MIXING AND HEAT TRANSFER PHENOMENA BETWEEN A PARTIALLY IONIZED GAS AND A GASEOUS COOLANT. Jerry Grey, Peter M. Williams, David B. Fradkin, Paul F. Jacobs, and Martin P. Sherman (Princeton Univ., N. J.). Nov. 1964. Contract AF33(657)-9962. 103p. CFSTI.

Mixing and heat transfer characteristics of a laminar subsonic argon arcjet issuing into a stagnant atmosphere of room-temperature helium were investigated by a combined analytical-experimental approach. Typical initial conditions of the one-centimeter-diameter jet were 20,000°R at one atmosphere, providing about 7% ionization of the argon. The analysis was based on classical continuum theory utilizing the boundary-layer approximation. Electron-heavy particle equilibrium was assumed, based on prior estimates for the specific conditions investigated, and the transport properties necessary for the solution were computed by a modified Chapman-Enskog method. Detailed local measurements of the mixing field were made up to five inches (about 12 jet diameters) downstream of the arcjet nozzle exit, utilizing a previously developed calorimetric sampling probe capable of measuring local values of enthalpy, stagnation pressure, and gas composition. Good correlation between theory and experiment was observed. Decay of the hot laminar jet was dominated by the inflow of helium, the observed effects of ion recombination, radiation, and jet dispersion being minor or negligible. As indicated by the theory, this behavior resulted from the high specific heat and high diffusion coefficients of helium at arcjet temperatures. Although the departure from equilibrium between the electrons and the heavy particles was estimated to be sufficiently small when considering the overall mixing process, it was shown analytically that this equilibrium probably did not exist in the regions of highest temperature gradient. It was, therefore, decided to explore the nature of this departure in the high-density (one atmosphere) collision-dominated, partly ionized gas by the use of a cooled electrostatic probe. The theory for such a probe was formulated, and it appears to provide the capability for measuring both electron concentrations and electron temperatures. This theory was confirmed in a rather approximate manner by a rough experimental check. (auth)

29389 (CLM-R-42) CULHAM LABORATORY STUDY GROUP ON PLASMA WAVES, SEPTEMBER 21-25, 1964. P. F. Little, A. N. Dellis, A. Paton, and M. J. Parkinson (Culham Lab., United Kingdom Atomic Energy Authority, Abingdon (England)). Dec. 1964. 44p. Dep.(mn); $1.10 (BIS); 5s. 6d. (HMSO).

A summary is presented of the contributions to the four main sessions (low-frequency waves, high-frequency waves, collisionless phenomena, and nonlinear phenomena). Some of the topics covered are acoustic waves, oscillations, instabilities, microwaves and cyclotron radiation, helicon waves, resonances, etc. (D.L.C.)

29390 (COO-1233-19) THERMONUCLEAR PLASMA STUDIES. Quarterly Status Report No. 8, October 31, 1964–January 31, 1965. (Wisconsin Univ., Madison. Physics Dept.). Jan. 31, 1965. Contract AT(11-1)-1233. 8p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Efforts during the period were devoted mostly to improvement of octupole instruments for observations of rapid plasma potential changes and detection of local electric fields. Most observations were made using linear quadrupoles. Research on observational problems associated with quadrupole injection processes is in progress. Work is also reported on development of inductive guns, and r-f apparatus for plasma diagnostics. (J.R.D.)

29391 (GA-6330) INTENSE MICROWAVE RADIATION FROM A DENSE, UNSTABLE PLASMA. C. B. Wharton, T. H. Jensen, and F. R. Scott (General Atomic, San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science). Apr. 23, 1965. 20p. (CONF-650703-1)

From IUPAC Conference on Properties and Uses of Plasma, Moscow.

Intense microwave radiation was observed, emanating from a plasma injected from a high density plasma source and trapped in an evacuated region with a fast-rising magnetic mirror field. There appear to be two distinct classes of radiation: one class occurs at the electron cyclotron frequency harmonics; the second class is irreproducible and appears to originate in some kind of an instability. The intensities of both classes are enormous, in some cases 10^6 times the black-body radiation levels. There is evidence that the spurious (Class II) radiation dominates under conditions in which the plasma is flute-unstable. Under conditions of flute stability the Class II radiation diminishes and the harmonic signals (Class I) become apparent. In the flute-stable conditions, anomalous radial diffusion is observed, however, suggesting the presence of other instabilities. Discussions of some possible theoretical explanations and some applications to plasma diagnostic techniques are also presented. (auth)

29392 (IPP-4/12) THE 2.6 MJ. CAPACITOR BANK AT GARCHING — ARRANGEMENT AND COLLECTOR SYSTEM. A. Knobloch (Institut fuer Plasmaphysik, G.m.b.H., Garching (West Germany)). June 1964. 18p. (CONF-640604-2). Dep.(mn).

From 3rd Symposium on Engineering Problems in Thermonuclear Research, Munich.

The 2.6-MJ capacitor bank is designed to produce a large theta-pinch discharge. The collector system operates with maximum charging voltage 40 kv and maximum current about 22×10^6 amp at 27 kc. The arrangement and material composition of the pulse cables between the capacitor bank and collector, the precollectors, and the collector coils are described. Model and analog measurements of the apparatus are given. (M.J.T.)

29393 (IPPJ-30) PROPAGATION OF HYDROMAGNETIC WAVES IN COLLISIONLESS PLASMA. [PART] II. Yusuke Kato, Masayoshi Tajiri, and Tosiya Taniuti (Institute of Plasma Physics, Univ. of Nagoya (Japan)). Sept. 1964. 23p. Dep.(mn).

The propagation of a hydromagnetic wave diverging from a point source is investigated graphically as well as analytically, for a collisionless plasma. Then, the general theory of steady flows is given, and the detailed discussion is done for the two-dimensional aligned field-flow in which the directions of magnetic field and flow are aligned everywhere. All the discussions are based on the Chew-Goldberger-Low approximation. (auth)

29394 (IPPJ-32) ANOMALOUS BREMSSTRAHLUNG AND ANOMALOUS CYCLOTRON EMISSION FROM PARTIALLY IONIZED GASES. Shigetoshi Tanaka, Tadao Honzawa, Hideo Ikegami, and Kazuo Takayama (Institute of Plasma Physics, Univ. of Nagoya (Japan)). Nov. 1964. 43p. Dep.(mn).

The anomalous emission at the electron cyclotron frequency in a partially ionized plasma was measured and studied in the range of radio frequency below 1000 Mc, which had been observed in the microwave region and reported previously. The anomalous cyclotron emission could be observed only when the detecting frequency was above some critical frequency ω_{crit}. The anomalous emission appeared also at the 2nd cyclotron harmonic. The ω_{crit} was in the range from 70 to 40 Mc and was somewhat smaller than the collision frequency of plasma electrons. On the other hand, another anomalous emission (anomalous bremsstrahlung) was observed in the rather weaker external magnetic field when the detecting frequency ω was less than the ω_{crit}. The characteristics of both anomalous emissions were very similar and would be explained by the same physical mechanism. Therefore, the following interpretation is proposed: if the anomalous cyclotron emission is resulting from the effect of negative absorption due to the cyclotron radiation, then the anomalous bremsstrahlung can be interpreted as a phenomenon of the negative absorption due to the bremsstrahlung. Moreover, it is reasonable that the anomalous cyclotron emission and the anomalous bremsstrahlung occur at a high frequency region ($\omega > \omega_{crit}$) and at a low frequency region ($\omega < \omega_{crit}$), respectively. (auth)

29395 (NASA-TN-D-2806) EQUILIBRIUM COMPUTATIONS FOR MUTICOMPONENT PLASMAS. Frank J. Zeleznik and Sanford Gordon (National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center). May 1965. 26p. $1.00(CFSTI).

A method is presented for the calculation of multicomponent plasma properties. The method includes both Debye-Hückel and ionization potential lowering effects. These effects are shown to be partially compensating. A perturbation technique is used to make the calculation compatible with a scheme used for calculating ideal gas properties. Thermodynamic derivatives, such as heat capacity, can be calculated directly. (auth)

29396 (R65SD-7) FLOW EQUATIONS FOR CHEMICALLY REACTING PLASMA. Richard B. Thomas, Jr. (General Electric Co., Philadelphia, Pa. Missile and Space Div.). Apr. 1965. 41p.

The theoretical basis for the treatment of the broad class of fluid dynamic problems involving the flow of a chemically reacting gas was developed. The emphasis was placed on general principles and no attempt was made to give a complete account of all of the possible interactions that can take place in such complex systems. The mechanics of the collision process were, however, given special consideration since they lie at the root of further developments and must for this reason be clearly understood. Approximations which were generally used are clearly stated and explained. The Boltzmann equation was derived and some elementary solutions were obtained. The results were used to obtain the conservations laws, etc. The work should provide workers with a reasonable introduction to the theoretical methods and concepts of transport theory in gases. (auth)

29397 (SSD-TDR-64-184) THE RADIATION FIELD OF AN ELECTRIC DIPOLE ANTENNA IN A CONICAL SHEATH. A. Banos, R. H. Huddlestone, D. C. Pridmore-Brown, and E. C. Taylor (Aerospace Corp., El Segundo, Calif.). Oct. 30, 1964. Contract AF04(695)-469. 52p.

The radiation pattern of an electric dipole antenna situated on the axis of a cone of finite conductivity, such as a conical plasma sheath, is calculated. The mathematical analysis of the idealized model is carried out rigorously, and the solution is presented as a rapidly converging series of modes. Radiation patterns are given for parameter values of interest in re-entry situations. The dominant feature of the patterns is found to be the presence of a guided wave traveling out along the conical sheath. A discussion of the relevance of these results to the blackout problem is included. (auth)

29398 (UCRL-12234) ADVANCED RESEARCH IN CONTROLLED FUSION. Harold P. Furth and Richard F. Post (Lawrence Radiation Lab., Univ. of California, Livermore). Dec. 10, 1964. Contract W-7405-eng-48. 16p. Dep.; $1.00(CFSTI).

A brief discussion is presented of past research on controlled thermonuclear reactions and of the direction that future research should take. The problem of stable plasma confinement is considered in some detail, and five reservoirs of free energy for driving instabilities are listed. The possible experimental approaches to the stability problem are discussed. (D.L.C.)

29399 EXPERIMENTAL STUDY OF THE FLOW OF A MAGNETIZED PLASMA THROUGH A MAGNETIC DIPOLE FIELD. L. Danielsson and L. Lindberg (Royal Inst. of Tech., Stockholm). Arkiv Fysik, 28: 1-16(1965).

In a model experiment, a plasma is shot towards a magnetic dipole to simulate the interaction between the solar wind and the earth's magnetic field. The interaction is studied by means of electric and magnetic probes and Kerr-cell photography. It is found that the plasma penetrates deep into the dipole field. However, at the same time the electric field is substantially reduced in the vicinity of the dipole. (auth)

29400 CONCERNING THE MEASUREMENT OF THE ELECTRONIC TEMPERATURE FROM THE RATIO OF THE HELIUM LINE INTENSITIES. I. M. Podgornyi and G. V. Sholin Dokl. Akad. Nauk SSSR, 160: 575-7(Jan. 21, 1965). (In Russian)

It is shown that the determination of the electron temperature from the ratio of the intensities of certain helium lines (2^1P-4^1D 4922 Å and 2^3P-4^3S 4713 Å) may sometimes give incorrect results. In particular, there exist processes which limit the possibility of the use of this method when the plasma concentration rises above a certain critical value, for then the populations of the 4^1D and 4^3S levels are determined not only by excitation from the ground state and by spontaneous emission, but also by transitions, due to electron collisions, between states within a given principal quantum number. The conditions when the contribution of the collision transitions become appreciable are determined. A value of 10^{12} cm^{-3} is obtained for the critical electron density in the plasma. At this density and for an electronic plasma temperature of 5 ev the temperature determined from the ratio of the intensities of the 4713 and 4922 Å lines may be overestimated by a factor of 2. The method is therefore applicable only at concentrations smaller than 3×10^{11} cm^{-3}. Formulas are derived for the relative probabilities of the col-

lision transitions. Conditions under which the error is minimized are briefly discussed. (ATD)

29401 ELECTROMAGNETIC WAVES ALONG AN INFINITELY LONG AND THIN CONDUCTING WIRE IN A MAGNETOIONIC MEDIUM. Yasuto Mushiake (Tohoku Univ., Sendai). J. Res. Natl. Bur. Std., 69D; 503-10 (Apr. 1965).

The electromagnetic fields of an infinitely long conducting cylinder in a magnetio-ionic medium with axial static magnetic field are theoretically analyzed. Expressions for the electromagnetic fields and the dispersion formulas are obtained. Explicit approximate expressions for the relative propagation constants for the case of an extremely thin wire are derived, and their dependence on the plasma and the cyclotron frequencies is discussed. The behavior of the electromagnetic fields around the wire is also discussed. (auth)

29402 RADIATION FROM AN INFINITE AXIAL SLOT ON A CIRCULAR CYLINDER CLAD WITH MAGNETO-PLASMA. Phillippe de Marchin and G. Tyras (Univ. of Arizona, Tucson). J. Res. Natl. Bur. Std., 69D: 529-38 (Apr. 1965).

The effects of a magnetoplasma layer on the radiation properties of an infinite axial slot on a circular cylinder when a finite magnetostatic field is in the axial direction are investigated. Formulas are obtained for the fields everywhere around the cylinder and for any thickness of the magnetoplasma. The solution is simplified by a first-order approximation, valid only for small thicknesses of the layer. For a small "k_0a" the harmonic series converges well and is used for numerical computations. For large "k_0a" the convergence is improved by applying the Watson's transformation. Distortion, attenuation, and asymmetry of the radiation pattern are shown as a function of the strength of the magnetostatic field. It is found that the reversal of the orientiation of the magnetostatic field produces a shift of the pattern to a mirror-image position. (auth)

29403 INDEX OF REFRACTION SURFACES FOR PLASMA WAVES. Tyan Yeh (California Inst. of Tech., Pasadena) and Marshall H. Cohen. J. Res. Natl. Bur. Std., 69D: 539-57(Apr. 1965).

Surfaces of index of refraction were calculated for the four modes which exist in a warm plasma, ignoring all damping mechanisms. The surfaces are displayed as contour diagrams. Dispersion curves are obtained as profile cuts through the surfaces. (auth)

29404 IMPEDANCE OF A SHORT DIPOLE IN A COMPRESSIBLE PLASMA. K. G. Balmain (Univ. of Illinois, Urbana). J. Res. Natl. Bur. Std., 69D: 559-66(Apr. 1965).

The field of a cylindrical dipole antenna in a compressible isotropic, lossy plasma is represented by the field of a cylindrical current sheet immersed in the plasma. The antenna is short compared to a free-space wavelength, and for this reason a triangular current distribution is assumed. A formula for the input impedance is derived and compared with existing formulas for spherical, cylindrical, and planar geometries. In addition, the effect of contact between the plasma and a metal antenna is estimated in the low-frequency limit for the case of an antenna biased to the point of ion-sheath collapse. (auth)

29405 WAVES CIRCULATING AROUND A RIGID CYLINDRICAL OBSTACLE IN A COMPRESSIBLE PLASMA. James R. Wait (National Bureau of Standards, Boulder, Colo.) J. Res. Natl. Bur. Std., 69D: 567-77(Apr. 1965).

The propagation of waves in a compressible plasma, bounded by a rigid convex surface, is considered. The situation is idealized to the extent that Maxwell's equations, when combined with continuum theory of fluid dynamics, are separable. Specifically, the model is a perfectly conducting cylinder of infinite length, which is excited by a uniform voltage applied to an axial slot. It is shown that both electromagnetic and electroacoustic waves are excited in the plasma. Of particular interest is an azimuthal surface wave which circulates around the cylinder with exceptionally low attenuation. In the limiting case of a cold (imcompressible) plasma, the surface wave is not excited. (auth)

29406 WAVE PROPAGATION IN A TWO COMPONENT WARM PLASMA. S. R. Seshadri (Sylvania Electronic Systems, Waltham, Mass.). J. Res. Natl. Bur. Std., 69D: 579-97(Apr. 1965).

A treatment of the characteristics of a plane wave propagating in a homogeneous, unbounded, and fully ionized plasma is given by employing the linearized, two-fluid continuum theory of plasma dynamics. The plasma is assumed to be a macroscopically neutral and loss-free mixture of gas of electrons and singly charged ions. The dispersion relations for the general case of propagation at an arbitrary angle to the direction of the static magnetic field are investigated without any limitation on the frequency and with emphasis on the coupling of the tranverse and the longitudinal waves. Simple analytical expressions for the dispersion relations in the various intervals of frequency and phase velocity, as well as for the frequencies where the tranverse and the longitudinal type waves couple, are given in terms of the various parameters. This treatment does not cover the cases in which the propagation vector is in the close neighborhood of either the direction of the static magnetic field or that perpendicular to it. (auth)

29407 HARMONIC CURRENTS EXCITED BY AN ELECTROMAGNETIC WAVE IN A PLASMA. Lewis Wetzel and Ting-Wei Tang (Brown Univ., Providence). J. Res. Natl. Bur. Std., 69D: 599-607(Apr. 1965).

The major sources of harmonic currents excited by an electromagnetic wave in an isotropic plasma are reviewed. The discussion is based on the assumption that a plane wave of prescribed form interacts with a plasma whose response is described by the usual macroscopic equations for the electron velocity, density and temperature. Nonlinear interactions arising from the magnetic field of the plane wave, the dependence of the collision frequency and other rate parameters on the electron temperature, and the oscillating space-charge induced by the wave in regions of inhomogeneity are examined in sufficient detail to provide an estimate of their relative importance in producing harmonic currents in various situations. The physical orgins of these currents are discussed, and a characteristic perturbation parameter is provided for each of the interactions. (auth)

29408 EXCITATION OF ACOUSTIC WAVES IN PLASMAS. William A. Saxton (Harvard Univ., Cambridge, Mass.). J. Res. Natl. Bur. Std., 69D: 609-16(Apr. 1965).

Preliminary results in an experimental study to determine the effects of perturbing weakly-ionized gaseous plasmas with acoustic waves emanating from transducers that operate in the audio and ultrasonic frequency ranges are reported. Compact loudspeakers incorporated into cylindrical plasma discharge tubes provide the source of acoustic signals. Modulation of electromagnetic waves by the acoustically-disturbed plasma is measured in a unique rectangular cavity, the output of which is detected and fed to a wave analyzer. Resultant wave-analyzer responses indicate that the collision frequency is modulated in addition to the plasma frequency and suggest that the variations in both are proportional to the magnitude of loudspeaker diaphragm deflection, as predicted by simple acoustic theory. Knowing that two forms of modulation occur simultaneously, a calibration scheme was developed to separate the variation $\Delta \int_p$ in the plasma frequency from the total response. Measurements to date indicate that $\Delta N_e / N_e = \Delta N/N$ (where N_e and N are electron and neutral-molecule densities, respectively) for slightly-ionized gases which are subjected to low-frequency pressure variation in the order of 10^{-5}mm Hg and that such variations produce plasma-frequency perturbations of 0 to 140 kc/s at plasma frequencies up to 800 Mc/s. (auth)

29409 WAVE INTERACTION IN OXYGEN MAGNETO-PLASMAS. K. V. Narasinga Rao (Air Force Cambridge Research Labs., Bedford, Mass.). J. Res. Natl. Bur. Std., 69D: 617-22(Apr. 1965).

Electron cyclotron resonance absorption of microwaves in decaying oxygen magnetoplasmas is utilized after the

plasma parameters such as the temperature and number density of the electrons. The technique of cross modulation of microwaves in partially filled plasma waveguides is used in this investigation. It is shown that for small amplitudes (~120 mw at 5.3 Gc/s) of the resonant heating signal, the inelastic collision of low energy electrons introduce a barrier for rapid heating the electron gas. For higher incident amplitudes (~500 mw at 5.3 Gc/s, not only does rapid heating of the electron gas occur, but also additional electron production and loss mechanisms are observed. The implications of these results for apparent discrepancies in measurements of attachment coeffient by microwave methods and control of ionospheric plasma parameters by radio wave-absorption are discussed. (auth)

29410 MAGNETIC PROBE MEASUREMENTS ON A COAXIAL PLASMA GUN. Suckhi Be and Yoshiei Nakano (Tokyo Inst. of Tech.). Kakuyugo-Kenkyu, 12: 386-405 (May 1964). (In Japanese)

The characteristics of a coaxial plasma gun with a fast-acting valve are described. The accelerating process for the plasma was studied by using a magnetic probe and photomultiplier tubes. The mechanism of the current sheet was shown more qualitatively by obtaining the magnetic field distribution between the electrodes. It was found that the velocity of the current sheet in a coaxial plasma accelerator changes with the polarity of the inner conductor. The velocity of the current sheet is about 6×10^6 cm/sec with the center conductor negative, and about 4×10^6 cm/sec when the center conductor is positive. The current sheet is accelerated during about 3 μsec after initiation of the discharge, when the conductivity of the gas is presumably rising to a high enough value to exclude the magnetic field. After that the current sheet proceeds wth a uniform velocity. There is a loop current between the current sheets. The loop current can be easily found by obtaining the radial current density distribution. Throughout the passage down the gun the current sheet in a coaxial accelerator is planar with the center conductor negative, and its thickness hardly varies along the accelerator. The radial current density j_r shows the 1/r variation. (auth)

29411 THE REMARKABLE EFFECT OF MANY-PARTICLE COLLISIONS ON TRANSPORT PROPERTIES OF NONDEGENERATE PLASMAS. Setsuo Misawa (Nihon Univ., Japan). Kakuyugo-Kenkyu, 13: No. 1, 45-52(July 1964).

The usual expression for the mean free path of electrons in nondegenerate plasmas (and accordingly most other transport coefficients related to the dissipative nature of the system such as diffusion, viscosity, and thermal and electrical conductivity) is not appropriate for describing the actual state of affairs realized in nondegenerate plasmas. Almost all theories on the transport properties so far developed have been based on the assumption of binary collisions. The usual theory following the language of the thermal Green's function is reviewed. Denoting the effective scattering cross section by $\Gamma(p,q)dq$, in which one electron with momentum P is scattered to p-q within a range dq, then $\Gamma(p,q) = 1/h\ \mathrm{Im}\{\beta^{-1}\Sigma_w G_0(p-q, \epsilon-w)\ [v(q)/\epsilon(q-w)]\}$ where β is the inverse temperature $1/kT$, $G_0(p,\epsilon) = [\epsilon-\epsilon_0(P)]^{-1}$, $v(q) = 4\pi e^2\hbar^2/q^2$, $\epsilon(q,w)$ is the wave number and frequency-dependent dielectric constant at finite temperatures. In the equation, $w = 2\pi i\ell/\beta$ and the summation is taken over all the integers ℓ. If the next higher Born approximations are taken, the cross section for a process in which the electron P is scattered to p-q and then rescattered to p-q-q′ by the medium within the ranged dq and dq′ is given by $\Gamma(p,q,q')dqdq'$, where $\Gamma(p,q,q') = 1/h\ \mathrm{Im}\ [\beta^{-2}\Sigma_w\Sigma_{w'}G_0(p-q,\epsilon-w)G_0(p-q-q',\epsilon-w-w')]\ [G_0(p-q',\epsilon-w') + G_0(p-q,\epsilon-w)]\ [v(g)/\epsilon(q,w)]\ [v(q')/\epsilon(q',w')]$. This consists of three types of scattering processes. A velocity $\ell_0/\ell \approx n/k_D^3\ (e^2/\hbar v_T)^2 \sim (1/k_D r_B)$, $r_B \equiv (\hbar^2/me^2)$. When applied to the ancient but notable Langmuir's experiment the equation explains the situation quite well. (NSA of Japan)

29412 DYNAMICS OF AN IRREVERSIBLE EXPANSION PROCESS RETAINING THE INITIAL TEMPERATURE. CASE OF A NON UNIFORM MAGNETIC CHANNEL. Shigeo Hamada (Nihon Univ., Japan). Kakuyugo-Kenkyu, 13: 493-516(Dec. 1964). (In Japanese)

The expansion of plasma into vacuum in a nonuniform magnetic channel and the thermalization by the production of shock waves are hydromagnetically considered in relation to the MACETIE experiment. The system of hydromagnetic equations is reduced to a system of equations for a one-dimensional problem under the assumption of low β. Approximate solutions for the plasma flow into a weak magnetic field from a straight strong field are deduced. An approximate solution for the plasma flow into a weak field from a strong mirror field is also deduced. In contrast to the case of a uniform magnetic channel, one of the former solutions produces a uniform supersonic stream with a certain length. The latter solution also produces a quasi uniform stream, the length of which is approximately proportional to the mirror ratio. The thermalization of these streams by shock formation is considered, and the results are compared with the statics of MACETIE. (auth)

29413 AXIALLY SYMMETRICAL UNSTEADY MOTION OF PLASMA IN A NON UNIFORM MAGNETIC CHANNEL. Shigeo Hamada (Nihon Univ., Japan). Kakuyugo-Kenkyu, 13: 517-30(Dec. 1964). (In Japanese)

A successive approximation method is proposed. The method is small β expansion. The plasma is assumed to be an infinitely conductive ideal gas. The hydromagnetic equations are rewritten in a time-dependent curvilinear coordinate system. The resultant equations are separable into two systems of equations. One of the systems is essentially representing a one-dimensional problem along each magnetic line of force. This problem is solvable in itself by numerical calculations when the time variation of the field is known. The other system of equations states that the Lorentz' force $j \times B$ must balance the other forces perpendicular to the lines of forces: pressure gradient, inertia, centrifugal force, and Coriolis force. These circumstances permit iteration when a zeroth order magnetic field, for example, vacuum field, is known and β is sufficiently small compared to unity. The proposed method should be carefully examined in relation to the singularity appearing in the case of small Alfvén number; however, that is now under way. (auth)

29414 MICROWAVE REFLECTION BY PLASMA WITH DENSITY GRADIENT. Takashige Tsukishima (Nagoya Univ., Japan). Kakuyugo-Kenkyu, 13: 541-9 (Dec. 1964).

In order to extend the applicability of the microwave reflection method for measuring electron densities higher than critical, reflections by a boundary layer with density gradient and also by an inhomogeneous plasma are examined. Approximate expressions for the reflection coefficient are derived for the respective cases. (auth)

29415 FINE STRUCTURE NEAR CYCLOTRON HARMONIC RADIATION. Seiko Ishii and Shigeo Hagiwara (Tokyo Univ.). Kakuyugo-Kenkyu, 13: 550-60 (Dec. 1964). (In Japanese)

The fine structure near electron harmonic resonances was observed in the radiation from a magnetoplasma. It is explained by taking account of electron temperature and spatial distribution of electron density. The explanation is based upon Bernstein's dispersion relation modified by employing a distribution function. The mechanism of the fine structure is the same as one Buchsbaum-Hasegawa mentioned. (auth)

29416 AN AXISYMMETRIC HELIOTRON MAGNETIC FIELD AND ITS STABILITY. Shigenori Hayashi and Hiroshi Oshiyama (Kyoto Univ.). Kakuyugo-Kenkyu, 13: 561-77(Dec. 1964). (In Japanese)

The stability of a hydromagnetic fluid in static equilibrium can be determined by an energy principle formalism investigated by I. B. Bernstein et al. The present purpose is to apply this method to a plasma in an axisymmetric Heliotron magnetic field In the case in which a plasma pressure is much less than a magnetic pressure, the stability condition for the flute type instability due to the $\epsilon_\varphi = f(\theta)/rB$ perturbation is given. In chapter 2, the

Heliotron magnetic field produced by the sheet current is studied. In chapter 3, the flute type instability is discussed. (auth)

29417 THE METHODS OF THE MEASUREMENTS OF TEMPERATURE AND ELECTRON DENSITY OF ARC PLASMA. Toshio Ito and Tetsuya Morikawa (Mitsubishi Electric Mfg. Co., Ltd., Japan). Mitsubishi Denki Giho, 38: No. 12, 8-11(Dec. 1964). (In Japanese)

Several methods of measurement of temperature, electron density, and their spatial distribution in arc plasma are reviewed. Estimations of temperature and electron density in the plasma jet of the MHD generator are made by the method of relative intensity of spectral lines. It is found that the temperature and electron density of the jet are about 4,300°K and 1.0×10^{13} cm^{-3} respectively. A method is presented to determine the partial pressure of seeding atoms for temperature estimation. The estimated value of the partial pressure of the seeding atom is approximately 3×10^{-4} $kg \cdot w/cm^2$. In the course of temperature estimation it is shown that the assumption of the Boltzmann distribution on the arc spaces is appropriate. (auth)

29418 EXPERIMENT OF HIGH TEMPERATURE PLASMA OF TOROIDAL SHAPE. Tadashi Kawai and Hiromichi Kondo (Mitsubishi Electric Mfg. Co., Ltd., Japan). Mitsubishi Denki Giho, 38: No. 12, 12-17(Dec. 1964). (In Japanese

Experimental results on the magnetic compression of toroidal He plasma obtained with the Mitsubishi toroidal discharge device are discussed. The plasma, heated by joule heating and having a circumferencial length of 2 m and a cross section diameter of 12 cm, was successfully compressed in a pulsed magnetic field of 8 kG until its diameter was $1/3 \sim 1/4$ of the initial size. This compressed plasma did not wriggle and had a sharp boundary. The confinement time of the compressed plasma was below 30 μsec on account of plasma drift to the outer wall caused by charge separation. Also the plasma temperature was observed to the extent of 2×10^5°K because of a large quantity of de-excitation loss produced by the plasma. Though the confinement time and the plasma temperature can be increased a great deal by enlarging the setup, further progress is essential in the principle of confinement and heating for the generation of thermonuclear plasma. (auth)

29419 PLASMA CONFINEMENT WITH HIGH FREQUENCY MULTI-POLE FIELDS. Hiromichi Kondo and Katsushi Toshioka (Mitsubishi Electric Mfg. Co., Ltd., Japan). Mitsubishi (Denki Giho, 38: No. 12, 18-21(Dec. 1964). (In Japanese)

Charged particles behave as if they were in a potential trough when they are inside a multipole electromagnetic field energized by high frequency currents with the frequency too high to retain the adiabaticit of particle motion. Such a field will provide a new idea of plasma confinement completely free from instabilities unavoidable in other schemes. The theory is given in the most reduced form and confirmed by several numerical calculatjons of the particle orbits. There is shown the scaling of the apparatus, which would be applied to the confinement of a thermonuclear deuterium plasma of 10 kev. A few engineering considerations are given to the circuitry and the coil dispositions to lighten the practical difficulties accompanying the setting up of the field. (auth)

29420 HIGH FREQUENCY COIL FOR PLASMA HEATING. Akihiro Mohri and Shigenori Hayashi (Kyoto Univ.). Oyo Butsuri, 34: 13-21(Jan. 1965). (In Japanese)

Time-varying electromagnetic fields, produced by electrodes or coils with a central axis and azimuthal and axial periodicities, are analyzed in general. As special cases of such a configuration, many types of electromagnetic fields, such as helical type, line-cusp type, and mirror type, are found and the characteristics of these fields are outlined. Many configurations of electromagnetic fields used for plasma heating can be reduced to these special cases. (auth)

29421 ČERENKOV RADIATION FROM CHARGED PARTICLES IN A PLASMA IN A MAGNETIC FIELD. W. Sollfrey and H. T. Yura (RAND Corp., Santa Monica, Calif.). Phys. Rev., 139: A48-55(July 5, 1965).

The Cherenkov radiation from electrons in a plasma in a magnetic field was calculated by Kolomenskiĭ, who determined the allowed frequency regions and the energy loss. It is shown that his results are in error. The allowed frequency regions have a much more complicated dependence on the plasma frequency, gyrofrequency, and electron velocity than he indicates, and he overestimates the energy loss for electrons in the earth's ionosphere by a factor of about 100. The total energy loss from slow electrons by Cherenkov radiation is comparable to their synchrotron loss, but is mainly at lower frequencies. For fast electrons, the Cherenkov loss is much smaller than the synchrotron loss. (auth)

29422 ENHANCEMENT OF PLASMA DENSITY FLUCTUATIONS BY NONTHERMAL ELECTRONS. Francis Perkins (Cornell Univ., Ithaca, N. Y.) and E. E. Salpeter. Phys. Rev., 139: A55-62(July 5, 1965).

In a plasma in thermal equilibrium, the spectrum of electron density fluctuations that have a wavelength longer than the Debye length has a sharp maximum near the electron plasma frequency. The effect of a non-Maxwellian electron velocity distribution on the spectrum of electron density fluctuations is computed for frequencies near the electron plasma frequency. The electron velocity distribution is assumed to be isotropic but not necessarily Maxwellian and the effects of electron-ion collisions are included. The results show how the presence of a small number of energetic electrons can enhance the intensity of the fluctuations near the plasma frequency, provided the Landau damping resulting from these energetic electrons is greater than both the collision damping and the Landau damping caused by the ambient electrons. The results are applied to the ionosphere radar-backscatter experiments, where the energetic electrons are photoelectrons produced by solar uv radiation. In the case of the Arecibo radar experiments, the intensity of the fluctuations near the electron plasma frequency is estimated to be enhanced at plasma frequencies greater than about 4 or 5 Mc. (auth)

29423 WHISTLER (OR HELICON) INSTABILITY IN PLASMAS WITH ELECTRON BEAMS. R. N. Sudan (Cornell Univ., Ithaca, N. Y.). Phys. Rev., 139: A78-82(July 5, 1965).

Growing whistlers, i.e., transverse electromagnetic waves propagating along the external magnetic field B_0, can exist in a gyrotropic plasma for anisotropic velocity distribution of the electrons. A previous analysis is extended to a plasma traversed by electron beams. Two approaches are adopted. In the first, an arbitrary complex phase velocity is assumed and the conditions on the plasma parameters for its existence may be investigated through a numerical procedure. In the second, the Nyquist criterion is employed to determine the wave vector and frequencies of marginally growing waves. Growth rates are obtained for wave vectors not differing appreciably from the marginal wave. An isotropic plasma is susceptible to growing waves in the presence of an electron beam under very weak conditions. It is possible to have situations suitable for the growth of whistlers but not for two-stream instability. (auth)

29424 POSSIBLE TWO-STREAM INSTABILITIES OF DRIFTED ELECTRON-HOLE PLASMAS IN LONGITUDINAL MAGNETIC FIELDS. B. Vural and M. C. Steele (Radio Corp. of America, Princeton, N. J.). Phys. Rev., 139: A300-4(July 5, 1965).

An analysis was made of the two-stream instabilities that can occur in a drifted solid-state plasma in the presence of a longitudinal magnetic field. In particular, the instabilities in an electromagnetic field which has both transverse- and longitudinal-electric-field components are considered. It was found that there are four possible nonconvective instabilities. These are discussed

in light of possible experiments to check the analysis. The potential importance of these instabilities is the relatively high frequencies (millimeter wavelength region) that might be generated. (auth)

29425 NONLINEAR SCATTERING OF RADIATION FROM PLASMAS. D. F. DuBois (Hughes Research Labs., Malibu, Calif.). Phys. Rev. Letters, 14: 818-22(May 17, 1965).

The scattering of a parallel beam of incident photons with frequency and polarization ω_0, $\hat{e}_0$ into the scattered beams $\omega_s = (\omega_0 - \omega)$, $\hat{e}_s$ and $\omega_A = (\omega_0 + \omega)$, $\hat{e}_A$ was investigated theoretically. (D.C.W.)

29426 CHARACTERISTICS OF THE RESONANCE PROBE. Toshihiko Dote and Torao Ichimiya (Inst. of Physical and Chemical Research, Tokyo). Riki Gaku Kenkyusho Hokoku, 40: 119-27(May 1964). (In Japanese)

The use of a resonance probe was proposed for the determination of the density, temperature, and collision cycle of electrons and was employed for measuring plasmas in the ionization layer. Some recent experiments provided results that could not be explained by the conventional theories. From these results, it is found that the cycle at which the resonance peak is attained may change in response to the d-c bias voltage of the probe and the deeper the voltage to negative the higher the cycle. The cycle will also change with the size of probe in such a way that the smaller the probe the higher the cycle. These matters are discussed and the equivalent impedance of the plasma and shell body is introduced. The experiments conducted on a typical probe to check the validity of the theories discussed are also described. (NSA of Japan)

29427 MHD PLASMAS INDUCED BY FISSION-FRAGMENT IONIZATION. M. S. Zucker, J. R. Powell, and G. Farber (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 8: 77-8(May 1965).

29428 FUSION-REACTOR BLANKET EXPERIMENT. P. S. Spangler, N. C. Rasmussen, and D. J. Rose (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nucl. Soc., 8: 213(1965).

29429 CURRENT-CONVECTIVE INSTABILITY OF COLLISIONLESS PLASMA. A. B. Mikhailovskii. Zh. Eksperim. i Teor. Fiz., 48: 380-2(Jan. 1965). (In Russian)

A type of plasma instability that does not depend on collisions between particles is examined. The equation containing this type of instability can be obtained by considering the motions of ions in the approximation of magnetohydrodynamics, assuming that their temperature equals zero and that the electron motion corresponds to a different approximation. Conditions for such an instability are derived for the case in which all electrons are fast electrons, and also for the case in which a fraction of the electrons are slow. The conditions of instability, for the latter case, depend on the ratio of slow to fast electrons. Although a nonlinear theory is necessary to obtain the details of the instability, a linear theory such as this is desirable to determine the boundary conditions for the appearance of the instability must come from a linear theory such as this. An experiment is cited in which an anomalous instability was observed, which appeared at a critical value of the ratio of slow to fast electrons, R_c, that is in qualitative agreement with the predictions of the linear theory developed here. (TTT)

29430 EXPERIMENTS ON HEATING OF IONS IN MAGNETIC MIRROR TRAPS WITH AID OF AN ALTERNATING ELECTRIC FIELD. Yu. V. Gott and E. E. Yushmanov. Zh. Eksperim. i Teor. Fiz., 48: 804-13(Mar. 1965). (In Russian)

Results are presented of an investigation of a new method for internal injection of a hot plasma into a magnetic mirror trap. The geometry was that of an "ion magnetron", and an oscillating voltage with a frequency equal to the ion cyclotron frequency was applied between the plasma column and the grounded chamber. In this way the trap could be filled with a hydrogen plasma with a density $\sim 10^{11}$ cm^{-3} and a mean ion energy ~ 5 kev, the pressure being kept down to $5 \cdot 10^{-7}$ mm Hg. The electrons remained relatively cold. The plasma created during the pulse decays in about 150 μsec, mainly as a result of flute instability. Ion heating was also observed at frequencies differing from the resonance frequency. It is suggested that the ion acceleration mechanism is of a stochastic nature. (auth)

29431 BEHAVIOR OF A PLASMA WITH A HIGH RADIATIVE PRESSURE IN A STRONG ELECTRIC FIELD. L. E. Gurevich and V. I. Vladimirov (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksperim. i Teor. Fiz., 48: 890-900(Mar. 1965). (In Russian)

Electric field heating of a completely ionized plasma in which the photon specific heat exceeds that of the electrons is considered. The steady state of the system is attained at the expense of the photon thermal conductivity. The photon distribution function is found for the case when heating of the photons is mainly due to Compton processes, but not to radiative processes. The distribution is found to be Maxwellian with a "chemical potential" determined by the condition of conservation of number of photons. Instabilities possible in such a plasma are considered, such as that due to unbounded (in the linear approximation) heating of the plasma, acoustic instability, and instability due to a falling volt-ampere characteristic in a strong magnetic field. (auth)

29432 THEORY OF THE OSCILLATIONS OF A PLASMA IN A HIGH-FREQUENCY ELECTRIC FIELD. Yu. M. Aliev and V. P. Silin (Lebedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 48: 901-12(Mar. 1965). (In Russian)

The potential oscillations of a totally ionized plasma in a strong high-frequency electric field are studied. It is shown that spatial dispersion may be due to the relative oscillations of the particles in the external field. The high-frequency field changes the existing oscillation branches and leads to the appearance of a new branch. It is also shown that the high-frequency field exerts a stabilizing effect on beam instability of a plasma in which the electrons move with respect to the ions. (auth)

29433 ON THE INTERACTION OF NEGATIVE ENERGY WAVES IN A WEAKLY TURBULENT PLASMA. V. M. Dikasov, L. I. Rudakov, and D. D. Ryutov. Zh. Eksperim. i Teor. Fiz., 48: 913-20(Mar. 1965). (In Russian)

It is shown that if a system contains quasi-particles (waves) with different energy signs, statistical equilibrium in the quasi-particle gas should not be possible. From the law of increase of the entropy of quasi-particles, it follows that the number of quasi-particles should grow infinitely. A concrete example is considered (interaction of oscillations in a plasma in which a low-density ion beam is moving) which confirms the general conclusions, and the rate of increase of the number of quasi-particles is estimated. (auth)

29434 ON THE POSSIBILITY OF "PULSATORY" DISTRIBUTIONS OF TURBULENT SOUND WAVES IN A PLASMA. I. A. Ahkiezer (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zh. Eksperim. i Teor. Fiz., 48: 928-30(Mar. 1965). (In Russian)

The types of turbulent sound-wave distributions which are established in a plasma consisting of cold ions and hot electrons moving with respect to the ions with supersonic velocity are studied. It is shown that besides stationary turbulent fluctuation distributions a different type of stationary fluctuation distributions is possible, a "pulsatory" distribution for which the random wave amplitude depends weakly on time, whereas their angular distribution is a periodic function of time. (auth)

29435 DYNAMIC STABILIZATION OF A PLASMA COLUMN. S. M. Osovets and V. I. Sinitsyn. Zh. Eksperim. i Teor. Fiz., 48: 1071-6(Apr. 1965). (In Russian)

Experiments are described in which the effect of dynamic stabilization of a plasma column carrying a current up to 10^5 amp was observed. A high frequency stabilizing magnetic field was produced by a comparatively weakly decaying discharge of condensors through rods arranged inside the discharge chamber around the plasma column. With aid of

ultra-high-speed moving film and magnetic probes it was found that if certain conditions are met, no instabilities are observed in this case which are inherent in a current-carrying plasma column. (auth)

29436 THEORY OF A TURBULENT PLASMA. L. M. Kovrizhnikh (Lebedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 48: 1114-31(Apr. 1965). (In Russian)

A closed system of nonlinear equations for the distribution function of particles in a plasma in an electromagnetic field is derived by assuming smallness of the energy density of the electromagnetic field and stochasticity of the wave phase. Explicit expressions are obtained for all coefficients encountered in the equations for the case of a plasma without an external magnetic field. (auth)

29437 SCATTERING AND TRANSFORMATION OF ELECTROMAGNETIC WAVES IN A TURBULENT PLASMA. I. A. Akhiezer (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zh. Eksperim. i Teor. Fiz., 48: 1159-67(Apr. 1965). (In Russian)

The interaction between electromagnetic waves and a turbulent plasma consisting of cold ions and hot electrons moving relative to the ions at supersonic velocities is investigated. Combinational scattering of tranverse electromagnetic waves on sound vibrations is considered as well as transformation of longitudinal waves into transverse as a result of interaction with the sound waves. It is shown that in the presence of turbulence the intensity of these processes is much higher than in the case of an equilibrium or quasi-equilibrium plasma. The dependence of the energy flux of the scattered radiation on the frequency and direction of the incident and scattered waves is established. It is shown that this dependence is determined to a large extent by the spectral and angular distribution of the turbulent oscillations. In principle this should permit one to use wave scattering and transformation effects for an experimental determination of the turbulence spectrum. Finally, spontaneous glow of the plasma due to transformation of random longitudinal waves into transverse waves as a result of interaction with the turbulent oscillations is considered. (auth)

Shielding

Refer also to abstract 28838.

29438 (APEX-502) XMA-1 SHIELDING TESTS USING SLABS OF ADVANCED SHIELDING MATERIALS. R. H. Clark (General Electric Co., Cincinnati, Ohio. Aircraft Nuclear Propulsion Dept.). July 1958. Contracts AF33 (600)-38062 and AT(11-1)-171. 26p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

Results of a series of tests that were conducted in the General Electric Outside Tank Facility during December 1957 and January 1958 are discussed. Emphasis is placed on the studies of the production of secondary gamma rays in Hevimet while in a beryllium medium, photoneutron production in beryllium, and the effect of hydrogeneous backing of nonhydrogenous materials. Some comparisons with calculated values are made. (auth)

29439 (CEX-63.3) BARRIER ATTENUATION OF AIR-SCATTERED GAMMA RADIATION. Z. G. Burson and R. L. Summers (Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.). Dec. 1964. Contract AT(29-1)-1183. 96p. Dep.; $1.00(cy), 2(mn) CFSTI.

An experimental study was conducted to determine the attenuation provided by vertical and horizontal barriers exposed only to skyshine radiation from cobalt-60 and cesium-137 sources. Materials of steel, aluminum, concrete, and wood were used as barriers. A sealed radioactive source was pumped at a uniform speed through a long length of flexible tubing to simulate a ring source. Point-source measurements were made by stopping the source at a given location. Dose measurements were made with ionization chamber detectors. Measurements of the attenuation provided by a vertical barrier were made in a bunker where three sides and the top were of sandbags or lead; the fourth side was the barrier of interest for each experiment. The simulated ring source was set at a 100-ft radius. Just inside the 100-ft radius line surrounding the bunker, the ground was shaped to rise up a slight ramp to create a circular-shaped plateau. The angle of the ramp was designed to insure that direct radiation would pass between 1 and 2 ft above the top of the barriers—only air-scattered radiation reached the barriers. Measurements of the attenuation provided by a horizontal barrier were made using detectors placed in a round hole in the ground, topped by the barrier material at ground level. A cobalt-60 point source was placed 100 ft from the hole. Sandbags or lead bricks were placed on the ground about 6 ft in front of the hole. The height of the lead bricks was the same height as the top of the shield. This assured that the shield was exposed only to air-scattered radiation. Additional measurements at this same location were made to determine: (1) the skyshine dose rate as a function of distance from a cobalt-60 source placed on an air-ground interface: (2) the geometry factor describing a detector response to scattered gamma rays at the air-ground interface from a point isotropic cobalt-60 source on the ground 100 ft away; and (3) lip scatter and wall backscatter corrections for a detector in an open hole exposed to skyshine radiation from cobalt-60. The results apply to a variety of shielding problems. One practical application is the shielding provided by basement roofs and exposed basement walls from skyshine radiation originating from fallout. (auth)

29440 (NAA-SR-Memo-10881) ANALYTIC TECHNIQUES FOR THE CALCULATION OF THE ORNL TOWER SHIELD EXPERIMENTS. PART III. ANNEX-3. R. S. Hubner (Atomics International, Canoga Park, Calif.). Jan. 5, 1965. Contract [AT(11-1)-Gen-8]. 71p. Dep. (mn); $3.00(cy), 2(mn) CFSTI.

Program ANNEX-3 is a modified version of ANNEX-2, NAA-SR-TDR-8516 Rev. The biasing techniques were extended to include selection of neutron path length, initial energy, and scattered direction. The source description was extended to include an isotropic source and a parallel beam source with a circular cross section. The inelastic scattering treatment was improved, and special routines for the inelastic processes in ^{6}Li and ^{7}Li were included. Multiple detector positions, slab or ring target geometry, the average deviation from the mean calculation, and the uncollided dose rate and flux calculation were added. (auth)

29441 (NASA-TN-D-2782) BACKSCATTERING AND SECONDARY-ELECTRON EMISSION FROM METAL TARGETS OF VARIOUS THICKNESSES. Allan J. Cohen and Kenneth F. Koral (National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center). Apr. 1965. 34p. $2.00(CFSTI).

Measurements were made of the number of backscattered and secondary electrons resulting from the impingement of primary electrons in the energy range 0.6 to 1.8 Mev upon thin targets of seven metals with atomic number 13 to 79. Included in the investigation were the effects upon backscattering and secondary-electron coefficients of changes in primary-electron energy and angle of incidence, as well as target thickness and atomic number. It was determined that a thickness equivalent to, or greater than, one-half range acts as an infinite backscatterer. Also, it was found that an energy-independent correlation of backscattering yield with thickness exists for each metal target. A linear increase in the secondary-electron coefficient with the backscattering coefficient was observed. Backscattering coefficients were measured as low as 0.4 percent and as high as 62 percent, and secondary-electron yields ranged from 1.1 to 5.2 percent. (auth)

29442 NUMBER TRANSMISSION OF FAST ELECTRONS THROUGH MATTER. Yohta Nakai and Koji Matsuda (Japanese Assn. for Radiation Research for Polymers, Osaka). Nippon Hoshasen Kobunski Kenkyu Kyokai Nempo, 5: 7-10(Nov. 1964). (In Japanese)

Experimentally determined electron transmission and backscattering coefficients for beryllium, aluminum, copper, and silver are given for source energies between 1.0 and 2.0 Mev. A comparison with Berger's calculations for aluminum shows that the calculated transmission values lie above the experimental curves. (auth)

29443 DOSE DISTRIBUTION FOR 6 Mv X-RAYS. Takeshi Hiraoka and Datsuhiro Kawashima (National Inst. of Radiological Sciences, Chiba, Japan). Nippon Igaku Hoshasen Gakkai Zasshi, 24: 1100-4(Dec. 1964). (In Japanese)

X rays from a linear accelerator with nominal energy of 6 Mev are employed for the experiment. An effective energy of 1.4 Mev for the x rays is deduced from a measurement of a half value layer with lead. The measurements of isodose charts are made using an automatic isodose plotter with a thimble ionization chamber in a water phantom. Depth dose curves near the surface of a medium are examined with a parallel plate ionization chamber in Lucite. It is thus deduced that the maximum dose in water occurs at 10 to 11 mm below the surface and the surface dose is about 15 per cent of the maximum ionization. The measured central axis depth dose curves for rectangular fields are compared with those estimated from an equivalent field method. The good agreement between the experiment and the equivalent method shows that the latter is applicable to 6-Mev x rays. (auth)

29444 SYMPOSIUM OF CONCRETE FOR RADIATION SHIELDING. Milos Polivka (Univ. of California, Berkeley). Trans. Am. Nucl. Soc., 8: 176(May 1965).

29445 DESIGN REQUIREMENTS OF SHIELDING CONCRETE. Walter O. Washington (Sumner Sollitt Co., Chicago). Trans. Am. Nucl. Soc., 8: 176-7(May 1965).

29446 APPLICATION OF PETROGRAPHY TO RADIATION-SHIELDING CONCRETE. Katherine Mather (Army Engineer Waterways Experiment Station, Jackson, Miss.). Trans. Am. Nucl. Soc., 8: 177-8(May 1965).

29447 AGGREGATES FOR RADIATION-SHIELDING CONCRETE. Leslie V. Whiton (Nuclear Shielding Supplies and Service, Inc., White Plains, N. Y.) and Harold S. Davis. Trans. Am. Nucl. Soc., 8: 178(May 1965).

29448 PROBLEMS OF HARDENED CONCRETE. J. L. Lott and C. E. Kesler (Univ. of Illinois, Urbana). Trans. Am. Nucl. Soc., 8: 178-9(May 1965).

29449 CALCULATIONS OF CONCRETE SHIELDS FOR FISSION SOURCES. J. P. Nichols (Oak Ridge National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 180-1(May 1965).

29450 HIGH-DENSITY CONCRETE FOR GAMMA AND NEUTRON ATTENUATION. T. E. Northup (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 181-2(May 1965).

29451 EFFECTS OF HIGH-TEMPERATURE EXPOSURE ON CONCRETE. Harold S. Davis (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 8: 182 (May 1965).

29452 SHIELDING PROPERTIES OF VARIOUS CONCRETES AS A FUNCTION OF TEMPERATURE. W. L. Bunch (Battelle-Northwest, Richland, Wash.). Trans. Am. Nucl. Soc., 8: 182-3(May 1965).

29453 LOW-BACKGROUND CONCRETE. Harold A. Wollenberg and Alan R. Smith (Univ. of California, Berkeley). Trans. Am. Nucl. Soc., 8: 183(May 1965).

29454 LOW-ACTIVATION SHIELDING MATERIALS FOR NUCLEAR REACTOR ENVIRONMENTAL TEST CHAMBERS. William G. Bingham, Jr. (Bechtel Corp., Vernon, Calif.). Trans. Am. Nucl. Soc., 8: 183-4(May 1965).

29455 NEUTRON ATTENUATION MECHANISMS IN CONCRETE. J. Greenborg (Battelle-Northwest, Richland, Wash.). Trans. Am. Nucl. Soc., 8: 184-5(May 1965).

29456 EXPERIMENTAL NEUTRON ALBEDO OF CONCRETE FOR REACTOR NEUTRONS. J. A. Kish, I. T. Myers and J. J. Smithrick (Lewis Research Center, Cleveland). Trans. Am. Nucl. Soc., 8: 186(May 1965).

29457 MEASURED AND PREDICTED VARIATIONS IN FAST-NEUTRON SPECTRUM ON PENETRATING LAMINATED Fe-D_2O. E. Aalto and R. Sandlin (Aktiebolaget Atomenergi, Studsvik, Sweden). Trans. Am. Nucl. Soc., 8: 186-7(May 1965).

29458 CALCULATING TRANSPORT AND HEAT DEPOSITION OF GAMMA RAYS BY S_N TRANSPORT PROGRAMS. R. K. Disney and H. C. Romesburg (Westinghouse Astronuclear Lab., Pittsburgh). Trans. Am. Nucl. Soc., 8: 190-1(May 1965).

29459 TRANSMISSION OF ISOTROPICALLY INCIDENT ELECTRONS THROUGH SHIELDING MATERIALS. W. K. Stromquist, H. P. Sleeper, Jr., and O. L. McDermed (General Dynamics-Astronautics, San Diego, Calif.). Trans. Am. Nucl. Soc., 8: 191-2(May 1965).

29460 BASEMENT RADIATION FROM AN INFINITE-PLANE GAMMA SOURCE. Arthur L. Kaplan (Technical Operation Research, Burlington, Mass.). Trans. Am. Nucl. Soc., 8: 193-4(May 1965.

29461 EVALUATION OF SHAPE FACTOR IN STRUCTURE SHIELDING CALCULATIONS. Jerry Waldman (Technical Operation Research, Burlington, Mass.). Trans. Am. Nucl. Soc., 8: 194-5(May 1965).

29462 SPACE RADIATION SHIELDING ANALYSIS BY PROGRAM CHARGE. W. R. Yucker and J. R. Lilley (Douglas Aircraft Co., Inc.). Trans. Am. Nucl. Soc., 8: 196-8(May 1965).

Solid State Physics

See also CHEMISTRY — Inorganic and Physical Chemistry
METALS, CERAMICS, AND OTHER MATERIALS — Properties and Structure

Refer also to abstracts 28992, 29383, and 29424.

29463 ENERGY EXCHANGE FROM Nd^{3+} TO Yb^{3+} IN CALIBO GLASS. G. E. Peterson, A. David Pearson, and P. M. Bridenbaugh (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Appl. Phys. 36: 1962-6(June 1965).

Studies of energy exchange from Nd to Yb in calibo glass were made using the technique of time-resolved spectroscopy. The rate of energy exchange between the systems was of the order of 3×10^4/sec, while the quantum efficiency for the process was estimated at 0.6. The mechanism is predominately nonradiative. (auth)

29464 EFFECTIVE CONDUCTION-ELECTRON-LOCAL-MOMENT EXCHANGE INTERACTION IN METALS: RARE-EARTH INTERBAND MIXING. R. E. Watson (Bell Telephone Labs., Inc., Murray Hill, N. J.), S. Koide, M. Peter, and A. J. Freeman. Phys. Rev., 139: A167-78 (July 5, 1965).

The effective diagonal-exchange parameter $J_{eff}(0)$ which determines the exchange splitting of a metal's Fermi-surface condition electrons, was investigated with a model involving simple orthogonalized-plane-wave conduction-electron orbitals and rare-earth ion cores. The positive exchange integral and the negative interband mixing contributions to $J_{eff}(0)$ were estimated for the rare earths as a function of nuclear charge Z. The results indicate that interband mixing may dominate, causing a net negative conduction-electron polarization, in agreement with a number of experiments. The interband mixing, and hence the sign of $J_{eff}(0)$, is found to be very sensitive to conduction-electron character. The results also indicate that, for ions other than spherical Gd, the parameter $J_{eff}(0)$ will vary strongly with conduction-electron k direction (with respect to the J of the rare-earth ion) and may even involve a variation in sign. Such anisotropies in $J_{eff}(0)$ and the non-

diagonal $J_{eff}(Q)$ parameters should be a significant source of anisotropies in the Ruderman-Kittel-Kasuya-Yosida conduction-electron spin distribution. (auth)

29465 TUNNELING IN LEAD SALT p-n JUNCTIONS. Robert M. Williams (RCA Labs., Princeton, N. J.) and John Shewchun. Phys. Rev. Letters, 14: 824-7(May 17, 1965).

The resistances of p-n junctions made by alloying In dots into p-type Pbs and PbTe and by alloying an In-Sn dot into PbSe were measured as a function of bias voltage to temperatures near 1°K. A strong temperature dependence of the resistance near zero bias was observed and was studied in some detail. Voltage structure was found in the form of spikes which split in a magnetic field. The data were compared with a phenomenological model in which a temperature-independent background is assumed. (auth)

29466 STABILIZATION OF SPIRAL INSTABILITY IN AN ELECTRON-HOLE SEMICONDUCTOR PLASMA BY AN ELECTRIC FIELD. L. V. Dubovoi and V. F. Shanskii. Zh. Eksperim. i Teor. Fiz., 48: 800-3(Mar. 1965). (In Russian)

The effect of a variable electric field on the development of spiral current instability in the plasma of a semiconductor in a magnetic field was investigated. Regions of instability damping or amplification due to the variable electric field were found in the experiments. The results obtained confirm the possibility of applying time-varying electromagnetic fields for stabilization of a plasma. (auth)

29467 EFFECT OF ANHARMONICITY OF THE PHONON SPECTRUM NEAR THE DEGENERACY POINT. Yu. Kagan and A. P. Zhernov. Zh. Eksperim. i Teor. Fiz., 48: 971-4(Mar. 1965). (In Russian)

The Green function method is used to investigate the effect of anharmonicity on the phonon spectrum near the degeneracy point. In contrast to the usual case, the effect of independent (in the harmonic approximation) phonon branches on each other requires a solution of the Dyson equation set. Cases of essential and accidental degeneracy are considered. It is shown that in the case of accidental degeneracy, the excitations which appear may possess lifetimes and a frequency renormalization which differ considerably in magnitude as well as in their temperature behavior. The cross section for single-phonon coherent scattering of neutrons near the degeneracy point is particularly investigated. (auth)

REACTOR TECHNOLOGY

General

Refer also to abstracts 28574 and 28926.

29468 (ANL-7017) REACTOR DEVELOPMENT PROGRAM PROGRESS REPORT, FEBRUARY 1965. (Argonne National Lab., Ill.). Mar. 18, 1965. Contract W-31-109-eng-38. 90p. Dep.; $3.00(cy), 2(mn) CFSTI.

Research and development is summarized on EBR-II, FARET, ZPR-II, ZPR-VI, ZPR-IX, ZPPR, fast reactor fuels, reactor physics, nuclear physics, high-temperature materials, engineering, chemical separation processes, plutonium recycle reactors, Argonne Advanced Research Reactor, regenerative rmf cells, and nuclear safety. (J.R.D.)

29469 (AP-Note-434) MANUAL OF PROCEDURES FOR OPERATION OF REACTOR ENGINEERING CODES AT ALCO. R. L. Caton, R. Zielinski, and J. M. Corkery (Alco Products, Inc., Schenectady, N. Y. Nuclear Power Engineering Dept.). June 26, 1962. Contract AT(30-1)-2639. 62p. Dep.(mn); $3.00(cy), 2(mn) CFSTI.

Reactor engineering codes available and in use at Alco for the IBM 650, IBM 704, IBM 7090, and Philco 2000 are described. Complete operating instructions and materials necessary to operate the codes are included. (L.B.S.)

29470 (EUR-2271.f) REPERTOIRE DES INSTALLATIONS NUCLEAIRES DE LA COMMUNAUTE EUROPEENNE DE L'ENERGIE ATOMIQUE. Troisieme Edition. (Nuclear Installations in the Countries of the European Atomic Energy Community. Third Edition). (European Atomic Energy Community). Jan. 1, 1965. 102p. Dep.(mn).

A survey is given of nuclear installations which already exist, which are under construction, whose construction has been decided, or which are being planned in the member countries of Euratom. For each installation, a short description of its main characteristics is presented, and the more important enterprises known to have participated in the building of these installations are mentioned. (auth)

29471 (EUR-2289.f) ORESTE T.I. — CODE STATISTIQUE POUR L'ETUDE HYDRAULIQUE ET THERMIQUE D'ELEMENTS COMBUSTIBLES. (ORESTE T.I. — Statistical Code for the Hydraulic and Thermal Study of Fuel Elements). B. Chambaud, J. C. De Bruyn, and M. F. Jamet (European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center and European Atomic Energy Community, Ispra (Italy). European Scientific Data Processing Center). Mar. 1965. 136p. Dep. (mn).

The determination of a reactor's performance takes into account the natural limits of the use of some components, for instance: maximum admissible temperatures for the coolant, the sheathing, or the fuel. Practically, to take into account uncertainty margins related to each value which appears in the determination of the performances, safety factors are introduced which lower the reactor behavior. ORESTE T.I., a Fortran Code on an IBM 7090 computer, calculates the performances of a reactor channel, taking into account statistical margins of uncertainty. (auth)

29472 (EURAEC-1289) STABILITY TESTS FOR BOILING WATER REACTORS. Quarterly Report No. 3, October 1 – September 31, 1964. (Allgemeine Elektrizitaetsgesellschaft, Frankfurt am Main (West Germany)). Work Performed under United States – Euratom Joint Research and Development Program. Contract 020-64-4 TEED. 55p. (EUR-2089). Dep.(mn); $3.00(cy), 2(mn) CFSTI.

The modifications to the test-rig were completed and work finished on the installation of the purification circuit. The new equipment was found to be satisfactory for the purposes of the tests. The density-measuring equipment was mounted on the test-rig and tested in operation. The influence of the scatter radiation was studied in measurements with collimated and uncollimated γ-beam. In order to eliminate the effect on the multiplier of a magnetic field, caused by the heater current, additional shielding was placed around the multiplier, after which the unit worked satisfactorily. A start was made on the calibration of the density-measuring equipment. Tests were prepared for further experimental studies on the velocity modulator control circuit. The equipment for measuring the throughput, pressure loss and subcooling was recalibrated, various reference gauges being installed on the test-rig. A start was made on the measurement of the heater power – void fraction and heater power – pressure loss frequency response curves. In the course of the theoretical work it was found that corrections had to be made to one of the essential starting formulae. Work could then be continued on the determination of the frequency response curve for the local variation in the void fraction, allowances being made for the local dependence of the mean void velocity. (auth)

29473 METHOD AND REACTOR SYSTEM FOR CONTROLLING THE AMOUNT OF FISSION GAS IN A HOMOGENEOUS BOILING NUCLEAR REACTOR. Olle Lindstroem (to Allmanna Svenska Elektriska Aktiebolaget). German Patent 1,189,214. Mar. 18, 1965. Priority date Dec. 2, 1959, Sweden.

The fission gas in the core of a reactor system comprising a reactor vessel in which nuclear reactor steam is produced from the moderator, heat from the steam being carried off during condensation of the steam in a primary steam circuit, is controlled by storing part of the fission gas generated in the core during operation of the reactor in the gas volume of a non-condensing gas that is circulated from a storage vessel to the reactor vessel and from there through a condenser back to the storage vessel. (Gmelin Inst.)

29474 STUDIES OF IODINE CHEMISTRY AND TRANSPORT IN THE NUCLEAR-SAFETY PILOT PLANT CONTAINMENT VESSEL. L. F. Parsly, Jr., L. F. Franzen, T. H. Row, and J. L. Wantland (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 142-3(May 1965).

29475 GAMMA-RAY MEASUREMENTS INSIDE A NATURAL-URANIUM HEAVY-WATER LATTICE. Douglas G. Andrews and Tasneem A. Khan (Univ. of Toronto). Trans. Am. Nucl. Soc., 8: 279-80(May 1965).

Auxiliaries and Components

Refer also to abstract 28805.

29476 A WIDE RANGE LOGARITHMIC AMPLIFIER FOR NERVA. G. A. Gilmour, C. E. Hardies, and J. H. Wilson (Westinghouse Electric Corp., Pittsburgh). IEEE (Inst. Elec. Electron, Engrs.), Trans. Nucl. Sci., NS-12: 346-50(Feb. 1965).

A logarithmic amplifier with an operating range from 10^{-12} to 10^{-2} amp is described. A logarithmic characteristic within plus or minus 2 % of a decade over the 10-decade operating range of the instrument was realized in the first model. Design improvements being incorporated in a second model include improved transient characteristics and an improved temperature compensation method. (auth)

29477 DIGITAL PERIOD METER UTILIZING MAGNETIC CORE. Yoshifumi Sakurai and Seiji Inokuchi (Osaka Univ.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 366-73(Feb. 1963).

A reactor period meter using a multi-phase magnetic counter as a neutron level comparator is described. (auth)

29478 TEMPERATURE AND THERMAL STRESS DISTRIBUTIONS IN CONCRETE PRIMARY SHIELDS FOR

NUCLEAR REACTORS. David R. Thomas (Westinghouse Electric Corp., Pittsburgh). Nucl. Struct. Eng., 1: 368-84(Apr. 1965).

The distribution of temperature and thermal stresses arising from the absorption of nuclear radiation in thick annular concrete shields was analyzed. Design criteria were developed relating maximum allowable incident energy fluxes to maximum allowable compression or tension stresses. A typical result for a 4.5-ft-thick shield was a maximum allowable incident energy flux of 85 Btu/hr-ft^2, resulting in a maximum temperature rise of 95°F in a shield cooled by plant container air on both inner and outer surfaces. The results were virtually independent of the nature of the incident radiation whether medium- or high-energy gamma radiation or neutrons. Stature, a Fortran digital computer code for study of thermal stresses arising from the absorption of nuclear radiation in both steel and concrete annuli is described. Use of Stature allows detailed calculation of the temperature and stress distributions in a shield within 12 sec when the computation is performed with the IBM 7090 digital computer. (auth)

29479 METHODS FOR THERMOVISCOELASTIC STRESS ANALYSIS IN CONCRETE REACTOR VESSELS. R. L. Taylor (Univ. of California, Berkeley). Nucl. Struct. Eng., 1: 385-94(Apr. 1965).

Problems in thermoviscoelasticity are considered. The displacement equations of equilibrium governing the behavior of stressed, isotropic, thermorheologically simple materials subjected to thermal variations were formulated with respect to integral constitutive equations. This led to a system of three, second order, variable coefficient, partial differential equations in spatial coordinates and integral equations in time. The general problem was formulated within the framework of classical, uncoupled thermoviscoelastic theory. A solution to the general displacement equations of equilibrium is presented for a point symmetric temperature field and point symmetric boundary conditions. The general theory was also formulated from the principle of virtual displacements. From the principle of virtual displacements, it is shown how exact, as well as approximate, solutions may be obtained. An example is included for the solution to an incompressible hollow cylinder subjected to an axisymmetric temperature field. (auth)

29480 A PROBLEM OF PRESTRESSED CONCRETE PRESSURE VESSELS: STRESS CONCENTRATION ADJACENT TO REINFORCED PENETRATION UNDER UNIDIRECTIONAL STRESS. A. N. Kinkead. Nucl. Struct. Eng., 1: 395-402(Apr. 1965).

Design philosophy for the advanced concept of the high-temperature gas-cooled reactor recommends easily removable and replaceable heat exchanger units, which are enclosed within the prestressed concrete pressure vessel. This results in relatively large penetrations in the vessel wall becoming a prime requirement. An individual circular opening in an infinitely wide slab of uniform thickness subjected to unidirectional stress in the plane of the slab is considered. The theory presented assumes that the reinforcement to the penetration (i.e., the shutter tube) is bonded to the slab material and that both materials behave in a perfectly elastic manner. A further simplifying assumption made in the development of the theory is that the reinforcement material is concentrated along the edge of the opening in the slab. Allowance is made for the difference in elasticity between the materials of the slab and its reinforcement at the penetration. The equations developed apply equally well to a similar plane stress problem where there exists the combination of any two elastic materials bonded together at a circular opening. A part of the theory developed may be applied directly to the case of hydrostatic plane stress conditions in the slab in the region adjacent to such a circular reinforced penetration. (auth)

29481 SAMPLING DEVICES USED IN NUCLEAR-SAFETY PILOT PLANTS. Peter P. Holz (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 141-2 (May 1965).

29482 A METHOD OF COMPUTING THE REACTIVITY WORTH OF ROD-CLUSTER CONTROL (RCC) ELEMENTS. William T. Sha (Westinghouse Electric Co., Pittsburgh). Trans. Am. Nucl. Soc., 8: 203-4(May 1965).

29483 NUCLEAR REACTOR CONTROL DEVICE. Jacques Lebey and Didier Costes (to Commissariat a l'Energie Atomique). British Patent 983,938. Feb. 24, 1965. Priority date July 27, 1962, France.

A nuclear reactor control device is described for rapid shut-down by introducing into the core a neutron-absorbing material in divided form. Means are provided for removing the neutron absorbing material when the reactor is started again. A vertical channel is provided in the reactor core in which a pressure prevails that is equal to the pressure in the fuel channels, and a reservoir disposed above the channel and adapted to receive a neutron-absorbing material make up the control system. A valve is provided between the channel and the reservoir that includes a closure member articulated to the reservoir and biassed by the difference between the pressure in the vertical channel and an adjustable pressure in the reservoir. Upon a predetermined drop of the pressure in the vertical channel, the valve opens and the material drops into the channel. The material return system is made up of a vertical tube that dips almost as far as the base of the vertical channel and is connected at its top end to a chamber disposed above the reservoir. The chamber is connected to the reservoir by way of a lock having two valves, and air pressure adjustment and the two valves serve to return the neutron-absorbing material to the reservoir. (B.L.M.)

29484 IMPROVEMENTS IN OR RELATING TO EXPERIMENTAL LOOPS FOR A NUCLEAR REACTOR. (to Societe Indatom). British Patent 984,128. Feb. 24, 1965. Priority date Jan. 18, 1962, France.

An experimental loop is described that consists of a revolving part free to turn about its axis. This rotating loop leaves no empty space in the core of the reactor, but ensures the continuity of the moderator-reflector zone of the reactor. A biologically protective screen is provided at each end of the revolving part. A moderator-reflector is placed in the neighborhood of the core of the reactor, and a thermal neutron absorber is provided in the neighborhood of the external protection of the reactor. At least one test channel parallel to the axis of rotation is placed in the moderator-reflector. As an alternate arrangement, the revolving part may have two moderator-reflector tanks separated by a thermal neutron absorber, and each tank may contain a test channel connected to a heat exchanger and to a pipe returning the cooling fluid. This type of loop makes it possible to place the test channel outside the field of radiation and to leave it to cool and deactivate during the period before it can be unloaded simply by rotating the assembly without emptying or disconnecting the test channel. (B.L.M.)

29485 IMPROVEMENTS IN OR RELATING TO GRABS FOR NUCLEAR REACTORS. Ralph Lee and Dennis James Dawson (to United Kingdom Atomic Energy Authority). British Patent 985,305. Mar. 10, 1965. Filed Jan. 9, 1961.

A grab is described that is suitable for engaging and lifting a tubular container and allowing the passage of articles through the grab into the tubular container. The grab is made up of a tubular body, an assembly of coupling members, and an assembly of engageable members. Either the coupling members or the engageable members are carried by the tubular body, and the other by the tubular container. The coupling and engageable members are of the sequentially operating type, and a locking device is provided for preventing the uncoupling sequence occurring while the container is supported by the tubular body of the grab. Holding means also are provided for holding the locking device in the locked position. (B.L.M.)

29486 IMPROVEMENTS RELATING TO NUCLEAR REACTORS. Dennis James Dawson, Harold Leatham, and Harold Holloway (to United Kingdom Atomic Energy Authority). British Patent 985,307. Mar. 10, 1965. Filed Apr. 7, 1961.

A nuclear reactor pressure-tight concrete containment is protected by at least one non-return valve placed over an aperture penetrating the concrete. The non-return valve includes a seat bounding the aperture, a hingedly supported flap closable on the seat under its own weight, and means for normally holding the flap closed against pressure exerting opening force upon it. An element that normally closes the flap is adapted to rupture with a snap action at a stipulated amount of internal pressure. A second containment is provided inside the first and encloses a core-containing pressure vessel and heat exchangers. (B.L.M.)

29487 IMPROVEMENTS RELATING TO NUCLEAR REACTORS. Arthur Shillitto, Walter Rose, and Peter Arthur Willard (to English Electric Co. Ltd.). British Patent 985,969. Mar. 10, 1965. Filed July 20, 1960.

A moderator core structure is made up of a plurality of layers of prismatic graphite blocks. Individual blocks in each layer have a longitudinally-extending fuel channel, and the blocks are arranged in a square lattice with transverse clearance spaces between adjacent blocks. At least some of the layers of blocks include a plurality of interengaging blocks each of which has at least two pairs of longitudinally-extending locating faces. In one pair of faces, each locating face is in a plane parallel to one axis of the square lattice, and in the other pair, each locating face is in a plane parallel to the other axis. The locating faces that make up each pair are on opposite sides of the block. The locating faces of transversely-adjacent blocks are arranged in opposed overlapping sliding relationship in order to maintain the blocks in correct position in the lattice without hindering the contraction or expansion of individual blocks in a transverse direction. At least one end of blocks in each layer is provided with means for preventing rotation of the blocks in that layer, and thus in all other layers, about their longitudinal axes. (B.L.M.)

29488 IMPROVEMENTS IN NUCLEAR REACTORS. (to Societe Anglo-Belge Vulcain). British Patent 986,474. Mar. 17, 1965. Priority date Mar. 9, 1961, Belgium.

An assembly for a nuclear reactor is described in which the fuel elements are fixed around a hollow cylindrical support only partially enclosing the support. The elements may be arranged around the support in a horseshoe like structure with the external contour of the structure being formed by four adjacent sides of a hexagon. The hollow center support has a high mechanical strength, and the space within the support can be used for inserting absorbing rods or a liquid moderator. (B.L.M.)

29489 IMPROVEMENTS IN SYSTEMS FOR ESTABLISHING AN ELECTRICAL CONNECTION ALONG A CHANNEL OF A NUCLEAR REACTOR. Jean Liemann (to Commissariat a l'Energie Atomique). British Patent 987,164. Mar. 24, 1965. Priority date June 23, 1962, France.

A system is described for transmitting an electrical signal, e.g., a potential difference indicating temperature, from jacket to jacket in a reactor in which the fuel elements are mounted singly or in groups in jackets disposed end to end in the fuel channel. The system includes electrical connections at each junction between jackets. Collector rings or ring segments are mounted on one jacket, and resiliently mounted contact studs mounted on the other jacket make contact with the rings solely on account of juxtaposition of the jackets. (B.L.M.)

29490 LOADING-UNLOADING MACHINE FOR NUCLEAR REACTORS. Paul Chemin (to Commissariat a l'Energie Atomique). British Patent 987,548. Mar. 31, 1965. Priority date Dec. 13, 1962, France.

A fuel loading-unloading machine is described that is shorter, lighter weight, has less radiation shielding, and includes provision for improved, simple, and rugged mechanisms for controlling the various functions of the machine. The machine includes a first arm for manipulating the plugs in the fuel channels and a second arm for manipulating the elements. A frame supports both arms in parallel relation, and means are provided for rotating the frame about an axis parallel to both arms so as to bring the selected arm into alignment with the axis of the fuel channel. Means are also provided for imparting axial displacements to each arm when aligned with the channel axis. (B.L.M.)

29491 A CONTROL ROD DRIVE FOR NUCLEAR REACTORS. (to Licentia Patent-Verwaltungs-GmbH). British Patent 987,880. Mar. 31, 1965. Priority date June 15, 1960, Germany.

In a control rod drive for a nuclear reactor, a mechanical system is combined with a fluid drive system. The fluid is the same as that used in the reactor as a coolant and/or moderator. The two drive systems are combined in such a manner that one drive is disposed concentrically inside the other. The control rod is carried by a hollow piston that forms part of the fluid drive system, but the control rod can also be moved by the mechanical drive system formed by an electro-mechanical device. Communication is provided between the pressure vessel of the reactor and the fluid drive system, which is maintained at a pressure slightly below the pressure in the reactor vessel; thus, during normal operation, a portion of the reactor coolant and/or moderator fluid will flow from the reactor vessel into the fluid drive system. The fluid drive system may be connected to a by-pass filter plant through which the coolant and/or moderator fluid emerging from the fluid drive system is returned to the pressure vessel. (B.L.M.)

29492 COOLING CIRCUITS FOR LIQUID-MODERATOR NUCLEAR REACTORS. Didier Costes (to Commissariat à l'Énergie Atomique). Canadian Patent 677,232. Dec. 31, 1963. Priority date June 17, 1960, France.

A cooling circuit is provided for a liquid-moderator reactor of the type comprising an independent heat-carrying fluid circuit. The heat-carrying fluid passes through the pressure tubes containing the fissile material and arranged in the moderator liquid to remove the greater part of the heat formed in the reactor. The cooling circuit for the moderator, which may be either water or a suitable organic liquid, comprises a condenser and two channels. One channel connects the upper part of the moderator tank to the condenser and serves to admit to the condenser the vapor formed by the boiling of the moderator liquid. The second channel sends the condensate from the condenser back into the moderator tank by gravity. (B.L.M.)

29493 NUCLEAR REACTOR WITH BOILING COOLANT RESPONSIVE MOVABLE NEUTRON ABSORBER CONTROL. Albert Ziegler (to Siemens-Schuckertwerke AG). Canadian Patent 682,040. Mar. 10, 1964. Priority date Jan. 30, 1960, Germany.

A device having no electric circuits is provided for controlling a reactor having a core with fuel channels and a movable neutron absorptive control means. The regulatory motion of displaceable regulating elements is controlled by a boiling operation occurring in a selected liquid-cooled fuel element or unit of the reactor. A liquid-coolant supply means communicates with the bottom end of the channel and is adapted to cause boiling of the coolant in the chamber at a given operating condition below full power rating of the reactor. A vertical vapor chamber communicates with the top end of the selected channel and extends parallel to the channel in the core for the collection of condensed coolant. Forming a float in the vapor chamber is the movable control means that is immersed in the reactor core in accordance with pressure-responsive changes of the condensate level in the chamber. (B.L.M.)

29494 DEVICES FOR DETECTING BREAKS IN FUEL ELEMENT JACKETS IN A NUCLEAR REACTOR BY MEASUREMENT OF THE RADIOACTIVITY OF LIBERATED FISSION PRODUCTS. Jean Graftieaux and André Roguin (to Commissariat à l'Énergie Atomique). Canadian Patent 683,403. Mar. 31, 1964. Priority date May 20, 1960, France.

A device for detecting leaks in fuel element jackets is designed with special application for monitoring an independent experimental loop, which may contain fuel elements and through which a cooling gas flows in closed circuit. The device is made up of a chamber and a gastight casing

surrounding a rotating metallic drum, which has a positive ion repulsion electrode disposed opposite the periphery of the drum, and a radioactivity detector disposed opposite the periphery of the drum at some distance from the electrode. Means are provided for circulating a gaseous stream to be studied successively through the chamber and the space between the drum and the electrode. The periphery of the drum is divided into a plurality of areas including a recessed area and a non-recessed area; all other areas are called normal areas. The recessed area serves to trap a given volume of the gaseous stream between itself and the inner wall of the casing and to bring this volume into proximity of the detector. In response to the measurements made by the detector for the respective areas of the drum, a calculator means operatively connected with the detector provides the concentration of short-lived fission products, concentration of long-lived fission products, and the total activity of the gaseous stream. (B.L.M.)

29495 AUTOMATIC MONITORING DEVICES FOR LEAK DETECTION IN NUCLEAR REACTOR APPARATUS. Étienne Picard (to Commissariat à l'Énergie Atomique). Canadian Patent 684,740. Apr. 21, 1964. Priority date Feb. 17, 1959, France.

A method and device are described for monitoring the variations of a physical magnitude at a multiplicity of distinct points by means of a single instrument capable of measuring the magnitude. The device is particularly applicable to the detection of a fuel can burst in a gas cooled reactor. A digital computer comprises a part of the device and is adapted to treat the operating order for the sampling routine of the gas stream in the form of a coded indication. At least one decoding unit is arranged to receive sequentially from a registering unit the coded signals of different operating orders and to transform these signals into actual controlling orders distributed to the switching means. (B.L.M.)

29496 FUEL ELEMENT CHANGING AND TRANSPORTING APPARATUS FOR NUCLEAR REACTORS. Edwin Straub and Ernst Bosshard (to Sulzer Frères, S. A.). Canadian Patent 684,816. Apr. 21, 1964. Priority date Feb. 12, 1960, Switzerland.

An apparatus is described for changing and transporting fuel elements for a reactor of the type in which the rodlike elements extend through the moderator from one side to the other and in which means are provided for conducting a coolant in heat exchange relation with the rodlike elements. A head unit is placed on each element at one side of the moderator and an apparatus is placed at the opposite side of the moderator for withdrawing the element from and inserting elements into the moderator. The head unit includes connecting means and retaining means adapted to engage and releasably hold one element. The connecting means also includes a coolant circuit. The apparatus for removing the elements is adapted to travel from a storage tank to the reactor and includes a reciprocatingly movable mechanism adapted to individually engage one end of any selected element. The movable mechanism is contained in a cylinder of shielding material and is rockable to a position for receiving a spent fuel element from the reactor and presenting it to a hollow arm that communicates with the storage chamber. The reverse path serves to send new elements from storage chamber to moderator. (B.L.M.)

29497 MEANS FOR SECURING FUEL UNITS IN A NUCLEAR REACTOR. Eugen Guidi (to Sulzer Frères, S. A.). Canadian Patent 684,890. Apr. 21, 1964. Priority date June 8, 1960, Switzerland.

A simple and reliable device is patented for securing fuel units in a moderator that forms a part of a reactor in which the fuel elements include rodlike parts containing fissionable material and means for conducting a coolant in heat exchange relation with the rodlike parts. The securing device comprises a stationary connecting means adapted to be connected to coolant supply and relief pipes, a movable element adapted to press the fuel unit against the stationary element, and an elastic element interposed between the connecting means and the movable element. The elastic means takes the form of cup springs and urges the movable element to press the fuel element against the stationary means. The device facilitates exchange of fuel elements and maintains a desired adjustable pressure between the fuel elements and the connecting means independent of variable heat expansions of the associated parts and of changes of a seal between the connecting means and the fuel unit. (B.L.M.)

29498 NUCLEAR REACTOR GRAPHITE MODERATOR STRUCTURE. Georges Lemesle and Pierre Rouge (to Commissariat à l'Énergie Atomique). Canadian Patent 685,680. May 5, 1964. Priority date Mar. 15, 1958, France.

A mode of assembly for the moderator blocks of a solid moderator reactor is proposed. A ring type part of the same moderator material is inserted between the blocks of the moderator. The ring has a boring coaxial with that through the channel running through the two blocks to be assembled. The ring offers two plane surfaces machined perpendicularly to its direction of least Wigner effect. The ring plays a female role, and the outer surfaces of the ring coincide with those of the block of the pair. The mechanical assembly means consists of a mortice and tendon type arrangement. The new mode of assembly suppresses the leaks resulting from the interplay of the assembly components of the blocks and decreases the amount of waste raw material during fabrication. (B.L.M.)

29499 DEVICE FOR ANCHORING AND EXTRACTING PLUGS IN AND FROM FUEL CHANNELS OF NUCLEAR REACTORS. Pierre Cousseran, Roland Roche, and Jean M. Hassig (to Commissariat à l'Énergie Atomique). Canadian Patent 690,281. July 7, 1964. Priority date Aug. 16, 1961, France.

A device for anchoring and extracting plugs in and from fuel channels of nuclear reactors includes a clamp movable in relation to the plug provided with levers axially fast to the plug but pivoted on the plug. The pivotal arrangement allows radial movement of the levers in relation to the plug. The device is further characterized by a plurality of pawls pivoted on the plug that are adapted to lock the plug relative to the fuel channel to be closed. A locking member for the pawls is axially movable inside the plug between two positions in which the pawls are locked and released relative to the channel. Means for controlling the radial movements of the levers cooperate with means for controlling the axial movement of the clamps and levers in relation to the plug between three positions: (1) outer projections of the levers abut against the edge of the shoulder adjacent to the open end of the plug to stop the clamp at a predetermined distance from the plug, (2) inner projections of lever engage the locking member, and the levers are retracted to permit their introduction into the plug, (3) clamp contacts the plug, outer projections of the levers drivingly engage the shoulder and release the pawls, and the inner projections keep the locking member in the locked position. (B.L.M.)

29500 NUCLEAR REACTOR MODERATOR STRUCTURES. René Babule, Pierre Rouge, Georges Lemesle, and Roger Martin (to Commissariat à l'Énergie Atomique). Canadian Patent 692,475. Aug. 11, 1964. Priority date Oct. 18, 1958, France.

A moderator structure is described in which the moderator is made up of a plurality of parallel, substantially juxtaposed bars of moderator material having adjacent sides and cooperating longitudinal keying means located in the adjacent sides for interconnecting the bars laterally into a unitary structure. Stacks of bars make up columns that are also interconnected by keying means to adjacent columns. Preferably the moderator bars are of a prismatic shape with a hexagonal cross sectional contour. While the cooperating keys and keyways may assume various shapes in cross section, the rectangular shape is simple and satisfactory. The keying means may be separate key members insertable in grooves formed in the sides of the bars, or they may be longitudinal ribs projecting integrally from one bar and into complementary grooves in another

bar. Sufficient clearance is provided between all members in all directions to allow each column to expand and contract radially. The moderator is encased in a rigid metallic casing that is in turn enclosed in the conventional sealed tank or container. (B.L.M.)

29501 DEVICE FOR SUPPORTING A PRESSURE VESSEL PROVIDED WITH A FLANGE. Kenneth Alan Trickett and Merle Grassmann (to General Dynamics Corp.). German Patent 1,186,956. Feb. 11, 1965. Priority date Oct. 30, 1961, United States.

The reactor pressure vessel is supported in a containment in such a way that radial expansion and contraction because of thermal stresses and horizontal movement of the vessel is possible. The device comprises two supporting means one of which is mounted on a portion of the outer circumference of the vessel extending therefrom in a radial direction, and the other being fixed on the containment. (Gmelin Inst.)

Criticality Studies

See also PHYSICS — Criticality Studies.

29502 (CEA-R-2475) CALCUL DU FACTEUR ANTI-TRAPPE DANS LES RESEAUX A EAU LOURDE. (Calculation of the Anti-Trap Factor in Heavy Water Lattices). Roger Naudet and Jean Mougey (Commissariat à l'Énergie Atomique, Saclay (France). Centre d'Études Nucléaires). 1965. 36p. Dep.(mn).

The calculation of the anti-trap factor of a lattice is complex when a large fraction of captures occurs in a range of energies where the spectrum in the fuel is considerably different from the simple dE/E law. This is particularly true for heavy water lattices in which the distances between the bars are generally fairly large with respect to the slowing-down length. In order to take into account this effect the constitution of the effective resonance integral is studied as a function of the energy, and the distribution in the fuel is calculated. An improved method of treating the statistical domain makes it possible to plot the curves of the cross-sections per unit lethargy for various shapes of the fuel. Furthermore, the slowing-down of the neutrons is studied using a Monte-Carlo method which makes it possible in particular to take into account the perturbations caused by the non-moderating rods. A study is also made of the problem of shielding effects due to the captures themselves. (auth)

29503 (CEA-R-2561) ALECTO II — ETUDES D'INTERACTION. (Alecto II — Interaction Studies). Jean-Paul Brunet, Christian Clouet D'Orval, Jean-Claude Mougniot, and Francois Penet (Commissariat à l'Énergie Atomique, Saclay (France). Centre d'Études Nucléaires). Jan. 1965. 102p. Dep.(mn).,

Weak interactions were experimentally studied with the tank of the critical assembly Alecto II and one, two, or three bottles containing solutions of various concentrations. In particular, the validity was studied of certain classical assumptions, shielding effects, screening and semi-reflection effects, importance of thermal coupling. The method of the "k_{eff}, solid angle" is shown to apply to such a system. The determination by divergence and pulsed neutron technique of the reactivity related to a millimeter of solution level affords the obtention of critical heights in terms of reactivity. (auth)

29504 (EUR-1910.e) CONTRIBUTION TO THE THEORY OF EXPONENTIAL EXPERIMENTS WITH FAST NEUTRONS. F. Storrer, P. Govaerts, F. Ebersoldt, and M. Stievenart (Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires). 1965. 28p. Dep.(mn).

An analytical approach to the problem of finding the asymptotic spectrum and the transient behavior of the flux near the boundaries is presented for fast systems. As the only way a neutron can gain energy is via fission and as the fission spectrum can be reasonably assumed to be independent of the incident neutron energy, the flux behavior can be found by considering separately the transport of neutrons between successive generations of fissions and by linking these generations together by the use of convolution integrals. It is shown that in a finite homogeneous medium with arbitrary boundary conditions the flux away from boundaries and sources usually tends to an asymptotic energy mode. In addition there are transient modes corresponding to transients due to the first collisions close to a source, transients due to the anisotropy of the source, transient energy harmonics, and spatial harmonics for each energy harmonic, depending on the geometry. The first two kinds of transients are known to consist of a continuous spectrum of solutions which at large distances decrease at least as $e^{-\alpha_t \min^r}$. For the third type multigroup methods always yield discrete modes. Most of these discrete modes so obtained decrease faster than $e^{-t \min^r}$, and hence can not really correspond to discrete modes. (auth)

29505 (FZK-211) COMPUTER CODES FOR REACTOR AND HAZARD ANALYSES AT NARF. J. W. McWhirter (General Dynamics/Fort Worth, Tex.). Mar. 1965. Contract AF29(601)-6213. 36p. (WL-TR-64-138). CFSTI.

A number of computer codes obtained from other facilities have been modified for computer utilization at the Nuclear Aerospace Research Facility (NARF). The following codes are presently operational and are, therefore, part of the NARF's reactor and hazard analysis capability: RISC, Radiological Inhalation Safety Code; AIREK-III, Reactor Kinetics Code; FAIM, One-Dimensional Multigroup Neutron Diffusion Code; 9-ANGIE, Two-Dimensional Multigroup Neutron Diffusion Code; MLFTHAN, Heat-Transfer Code; DTK, One-Dimensional Multigroup Neutron Transport Code; and DDK, Two-Dimensional Multigroup Neutron Transport Code. The characteristics of these codes are briefly described to indicate the services available at NARF. (auth)

29506 (GEAP-4845) PLUTONIUM SUBCRITICAL EXPERIMENT PROGRAM. Quarterly Report No. 3, January 1–March 31, 1965. J. G. Carver (General Electric Co., San Jose, Calif. Vallecitos Atomic Lab.). Apr. 1, 1965. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(04-3)-189. 19p. (EURAEC-1374). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Nuclear analysis of lattices for use in determining physics data on light water-moderated Pu-enriched UO_2 cores is in progress, along with research on resonance absorption in fuel lumps as affected by flux spatial and energy variations. Plans and foil specifications are complete for measurement of fission and conversion rates and resonance absorber activation rates. A NaI crystal was set up to serve as a general purpose counter. (J.R.D.)

29507 (IDO-17002) ADDENDUM TO THE SPERT IV HAZARDS. SUMMARY REPORT — CAPSULE DRIVER CORE. R. W. Miller, R. K. McCardell, and T. F. Lagier (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.). Feb. 1965. Contract AT(10-1)-205. 80p. Dep.; $3.00(cy), 2(mn) CFSTI.

The Addendum to the Spert IV Hazards Summary Report was prepared and submitted to the Atomic Energy Commission to explain all important features pertaining to a new pulsed irradiation reactor, the Capsule Driver Core, and to analyze the potential problems and hazards of operating this reactor in the existing Spert IV facility. The report is in the form of an addendum because, with the exception only of the reactor and certain aspects of the control system, all other features discussed in the previous Spert IV Hazards Summary Report still apply. Pertinent mechanical characteristics are explained in detail including changes made in the original Spert IV control system design. Nuclear characteristics of the core as determined both by calculation and experiment are included along with predicted kinetic behavior for stepwise reactivity insertions. Finally, several accident situations are postulated together with preventive measures, and a maximum referent accident is analyzed to obtain numerical estimates of the worst possible radiological hazards. It is concluded

that the Capsule Driver Core can be operated as intended and stay within the safety policies of the AEC. (auth)

29508 (IDO-17048) FUEL ROD EXPERIENCE DURING THE SPERT I DESTRUCTIVE TEST SERIES WITH A STAINLESS STEEL CLAD, ROD-TYPE CORE. J. Dugone and D. D. Wieland (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.). Mar. 1965. Contract AT (10-1)-205. 77p. Dep.; $3.00(cy), 2(mn) CFSTI.

A description of the fuel rod damage which occurred during the potentially destructive transient tests performed at Spert I in 1963 and 1964 is reported. The core used for the test series was a low-enrichment, UO_2-powder fuel with stainless steel cladding. Four fuel rods ruptured during the test series and approximately 25 percent of the fuel rods were mechanically bowed or discolored. The results of the metallurgical examinations of the fuel and cladding samples and information on the extent of damage experienced are included. (auth)

29509 (INR-574/IX-A) REACTIVITY MEASUREMENTS OF SAFETY RODS AND MOBILE FUEL ELEMENTS OF THE ANNA CRITICAL ASSEMBLY. Jacek Arkuszewski, Jacek Bouzyk, and Witold Suwalski (Institute of Nuclear Research, Warsaw (Poland)). Dec. 1964. 22p. Dep.

The reactivity of the safety rods and of the mobile fuel elements was measured in three core-reflector configurations investigated during the first critical experiments carried out on the ANNA Critical Assembly. Measuring methods, apparatus, and experimental procedure are described together with results and their interpretation. (auth)

29510 (KAPL-M-6408) MONEY—A REACTIVITY DATA REDUCTION PROGRAM FOR THE IBM 1620 COMPUTER. R. A. Reiter (Knolls Atomic Power Lab., Schenectady, N. Y.). Jan. 11, 1965. Contract W-31-109-eng-52. 11p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

The MONEY program for the IBM-1620 computer was written to analyze counter-type reactivity data. A weighted least squares method is used to reduce the data. The output includes the doubling time, the reactivity in cents, the growth constant, and the reactor multiplication constant. (auth)

29511 (KAPL-M-6445) TIM-3—A FLUX WIRE DATA REDUCTION PROGRAM FOR REACTOR PROTOTYPE EVALUATION. Sally A. Gazda (Knolls Atomic Power Lab., Schenectady, N. Y.). Feb. 15, 1965. Contract W-31-109-eng-52. 38p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

The TIM-3 program reduces flux wire activation data to a form useful for engineering and physics analyses. Standard reactor physics calculational methods are used in obtaining the decay corrected counts, depletion, and power distribution along the wires from uncorrected flux wire data. The data reduction involves the use of a series of averaging procedures and will automatically compensate for activation changes caused by spatial and time variations. TIM-3 processes up to 22 wires with 50 counting intervals per wire. The approximate running time is four minutes per case. (auth)

29512 AN INHOMOGENEOUS PERTURBATION THEORY WITH AN APPLICATION TO CHANGES IN THE THERMAL UTILIZATION OF A LATTICE CELL DURING FUEL IRRADIATION. Jeffrey Lewins (Univ. of Washington, Seattle). Nucl. Energy, 138-40; 143-7(May 1965).

An inhomogeneous perturbation theory is derived, suitable for calculating changes in weighted averages of steady state systems with a source when subjected to perturbations in properties, source or weighting function. Some applications for such a theory are suggested. As an illustration, the theory is used to predict the changes in the thermal utilization of a lattice cell during irradiation. The effects of fuel burnup, plutonium production, stable fission products, and xenon are considered in turn, leading to some sample calculations and brief graphical data. From these results it appears that an allowance for the effect of the inhomogeneity on the thermal utilization of a lattice cell may be a significant correction to conventional homogenized treatments. The theory and the example application are not self adjoint but, using simple diffusion theory, a quasi self adjoint situation arises for certain simple but nevertheless useful cell geometries. The general method, however, is applicable to more sophisticated models and to problems involving energy as well as spatial dependence. (auth)

29513 A STABILITY STUDY OF THE "PROGONKA" REACTOR CODE. Teresa Kulikowska (Inst. of Nuclear Research, Warsaw) and Zenon Szoda. Nukleonika, 10: 1-10(1965).

The numerical solution of the reactor equations in diffusion approximation is reported. The method called PROGONKA was used to carry out the calculations of the two group equations in one dimensional approach. The transformation of differential equations into difference equations was performed by dividing the reactor cross-sectional area into concentric rings in which the neutron density was assumed to be constant. The results thus obtained should not be dependent upon the number and density of mesh points. The calculations performed on the URAL-2 computer proved that assumption. (auth)

29514 APPLICATION OF BURNUP ANALYSIS TO PHYSICS STUDIES AT BATTELLE-NORTHWEST. D. E. Christensen (Battelle-Northwest, Richland, Wash.). Trans. Am. Nucl. Soc., 8: 8-9(May 1965).

29515 BURNUP DETERMINATION IN CERAMIC FUELS. R. W. Durham (Atomic Energy of Canada Ltd., Chalk River, Ont.). Trans. Am. Nucl. Soc., 8: 9-10(May 1965).

29516 PLUTONIUM AND URANIUM-MASS-SPECTROMETRY MEASUREMENTS ON IRRADIATED FUELS. J. Chenouard, M. Lucas, and R. Bir (Commissariat a l'Energie Atomique, Saclay, France and Euratom, Brussels). Trans. Am. Nucl. Soc., 8: 10(May 1965).

29517 A REVIEW OF Nd-148 AS A BURNUP INDICATOR. B. F. Rider, C. P. Ruiz, and J. P. Peterson, Jr. (General Electric Co., Pleasanton, Calif.). Trans. Am. Nucl. Soc., 8: 11-12(May 1965).

29518 USE OF TRITIUM TO MEASURE BURNUP OF FISSIONABLE NUCLIDES. D. L. Horrocks (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 12-14(May 1965).

29519 CURRENT BURNUP PROCEDURES AND FUTURE REQUIREMENTS OF HTGCR EXPERIMENTAL FUELS AT AAEC RESEARCH ESTABLISHMENT. M. Thackray and L. E. Smythe (Australian Atomic Energy Commission, Sutherland, New South Wales). Trans. Am. Nucl. Soc., 8: 14(May 1965).

29520 SOME PHYSICS ASPECTS OF PRESSURE-TUBE VS PRESSURE-VESSEL TYPE HEAVY-WATER REACTORS. K. Jirlow and B. Pershagen (Aktiebolaget Atomenergi, Stockholm). Trans. Am. Nucl. Soc., 8: 90-1(May 1965).

29521 FLOOD SAFETY OF THE MIXED-SPECTRUM SUPERHEAT REACTOR (MSSR). J. W. Hallam, R. K. Haling, and G. T. Petersen (General Electric Co., Pleasanton, Calif.). Trans. Am. Nucl. Soc., 8: 109-10(May 1965).

29522 RESULTS OF COMPARISONS OF THERMAL CALCULATIONAL MODELS FOR HETEROGENEOUS LIGHT-WATER-MODERATED PuO_2–UO_2 REACTOR SYSTEMS. H. A. Risti and H. E. Krug (Westinghouse Electric Co., Pittsburgh). Trans. Am. Nucl. Soc. 8: 199-200(May 1965).

29523 A METHOD OF CALCULATING THE REACTIVITY EFFECT OF NEUTRON STREAMING AS APPLIED TO ANALYSIS OF AN ANNULAR VOID IN A CYLINDRICAL. D. G. Oliver and R. H. Norman (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 8: 203(May 1965).

29524 CRITICAL DIMENSIONS OF WATER-REFLECTED SYSTEMS CONTAINING U-235–H_2O–Zr.

G. P. Rutledge, F. A. Dobbe, and C. H. Price (Westinghouse Electric Co., West Mifflin, Pa.). Trans. Am. Nucl. Soc., 8: 211-12(May 1965).

29525 AN APPICATION OF A FREE-FLIGHT DIFFUSION CONSTANT TO LOW-EPITHERMAL-FLUX CALCULATIONS. N. R. Candelore, J. D. Butler, R. C. Gast (Westinghouse Electric Corp., Idaho Falls, Idaho). Trans. Am. Nucl. Soc., 8: 212-13(May 1965).

29526 EFFECTS OF FLUX-SHAPE CHANGES ON POWER-EXCURSION BEHAVIOR. S. O. Johnson (Phillips Petroleum Co., Idaho Falls, Idaho), E. P. Gyftopoulos, and M. E. Radd. Trans. Am. Nucl. Soc., 8: 221(May 1965).

29527 SELF-LIMITING POWER EXCURSIONS IN LARGE REACTORS. William K. Ergen (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 221-2 (May 1965).

29528 LOS ALAMOS COUPLED REACTOR EXPERIMENTS. Herbert H. Helmick, Curtis G. Chezem, and Robert L. Seale (Los Alamos Scientific Lab., N. Mex.). Trans. Am. Nucl. Soc., 8: 222-3(May 1965).

29529 COMPARISON OF THREE VARIATIONAL METHODS APPLIED TO A KINETICS PROBLEM. H. Fenech and V. Orphan (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nucl. Soc., 8: 223-4(May 1965).

29530 SPATIAL DEPENDENCE OF THE DECAY RATES OF PROMPT-NEUTRON CHAINS IN REFLECTED REACTORS. R. A. Karam (Argonne National Lab., Ill.) Trans. Am. Nucl. Soc., 8: 224-5(May 1965).

29531 XENON-INDUCED OSCILLATIONS. Jose Canosa and Harvey Brooks (Harvard Univ., Cambridge, Mass.). Trans. Am. Nucl. Soc., 8: 225(May 1965).

29532 OPTIMAL CONTROL OF A SPACE-DEPENDENT NUCLEAR REACTOR. Isaac Kliger (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 233-4(May 1965).

29533 SYNTHESIS OF OPTIMAL REACTOR FEEDBACK CONTROL USING THE FIRST VARIATION. Phillip A. Secker, Jr. and Lynn E. Weaver (Univ. of Arizona, Tucson). Trans. Am. Nucl. Soc., 8: 234-5 (May 1965).

29534 OPTIMAL REACTOR SHUTDOWN PROGRAMS FOR CONTROL OF XENON POISONING. Gordon R. Woodcock (Marshall Air Force Base, Huntsville, Ala.) and Albert L. Babb. Trans. Am. Nucl. Soc., 8: 235(May 1965).

29535 REACTOR KINETICS STABILITY CRITERIA. Gerald S. Lellouche (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 8: 235-6(May 1965).

29536 APPLICATION OF THE PROMPT-JUMP APPROXIMATION TO PROBLEMS IN REACTOR STABILITY. David L. Hetrick (Univ. of Arizona, Tucson). Trans. Am. Nucl. Soc., 8: 236-7(May 1965).

29537 ANALOG STUDIES OF XENON OSCILLATIONS— THE EFFECT OF COOLANT RECIRCULATION ON SPATIAL STABILITY. K. J. Chock, S. Kaplan, and S. G. Margolis (Westinghouse Electric Corp., West Mifflin, Pa.). Trans. Am. Nucl. Soc., 8: 237(May 1965).

29538 A MODAL REPRESENTATION OF FAST-REACTOR SPECTRA. T. E. Murley and I. Kaplan (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nucl. Soc., 8: 238(May 1965).

29539 PHYSICS MEASUREMENTS OF MODIFIED TUNGSTEN-BASED ALUMINUM-REFLECTED FAST REACTORS. W. G. Knapp, R. C. Doerner, K. K. Almenas, C. E. Cohn, and R. A. Karam (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 241(May 1965).

29540 EFFECTIVE FISSION-RATIO MEASUREMENTS IN A SERIES OF FAST REACTORS. G. W. Main, F. H. Helm, and H. H. Meister (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 242-3(May 1965).

29541 FISSION-DISTRIBUTION MEASUREMENTS FOR URANIUM-235 IN THE CORE OF THE ENRICO FERMI FAST BREEDER REACTOR. Earl M. Page, Robert E. Horne, and Jacques Montfort (Atomic Power Development Associates, Inc., Detroit). Trans. Am. Nucl. Soc., 8: 244-5(May 1965).

29542 CRITICAL FACILITY MEASUREMENTS OF THE SODIUM-VOID COEFFICIENT IN A LARGE DISC-SHAPED FAST-REACTOR CORE. F. H. Helm, W. Y. Kato, G. W. Main, H. H. Meister, and G. K. Rusch (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 245-6(May 1965).

29543 THE INFLUENCE OF HETEROGENEITY ON THE MEASURED SODIUM-VOID COEFFICIENT IN A 950-LITER PANCAKE FAST CORE. G. K. Rusch, and F. H. Helm (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 246-7(May 1965).

29544 EXPERIMENTAL THERMAL-DISADVANTAGE FACTORS IN SOME VERY UNDERMODERATED, 3%-ENRICHED WATER–URANIUM OXIDE LATTICES. Allen R. Boynton (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 249(May 1965).

29545 A MEASUREMENT OF THE FAST DISADVANTAGE FACTOR IN A LIGHT-WATER-MODERATED, SLIGHTLY ENRICHED URANIUM LATTICE. Henry E. Bliss (Massachusetts Inst. of Tech., Cambridge) and Glenn A. Price. Trans. Am. Nucl. Soc., 8: 250(May 1965).

29546 FAST-NEUTRON SPECTRA IN A LEAD-GRAPHITE ASSEMBLY. J. L. Russel, Jr., A. E. Profio, and K. L. Crosbie (General Atomic, San Diego, Calif.). Trans. Am. Nucl. Soc., 8: 250-1(May 1965).

29547 EXPERIMENTAL LATTICE PARAMETERS FOR 28-ROD CLUSTERS OF NATURAL UO_2 IN D_2O. R. E. Green, K. J. Serdula, and C. B. Bigham (Atomic Energy of Canada Ltd., Chalk River, Ont.). Trans. Am. Nucl. Soc., 8: 253-4(May 1965).

29548 CALCULATIONS OF ZED-2 LATTICES OF 28-ELEMENT UO_2 FUEL. I. H. Gibson (Atomic Energy of Canada Ltd., Chalk River, Ont.). Trans. Am. Nucl. Soc., 8: 254-5(May 1965).

29549 TEMPERATURE COEFFICIENT OF WATER LATTICES. J. T. Wajima, K. Yamamoti, and K. Matsuoka (Hitachi, Ltd., Ozenji, Kawasaki, Japan). Trans. Am. Nucl. Soc., 8: 255-6(May 1965).

29550 INTERPRETATIONS OF REACTIVITY MEASUREMENTS ON CADMIUM-SHIELDED SAMPLES. W. K. Foell and J. J. Scoville (Phillips Petroleum Co., Idaho Falls, Idaho). Trans. Am. Nucl. Soc., 8: 257-8(May 1965).

29551 NEUTRON-SCATTERING EFFECTS IN STATIC REACTIVITY MEASUREMENTS IN THE ARMF. J. W. Rogers, E. Fast, and D. A. Millsap (Phillips Petroleum Co., Idaho Falls, Idaho). Trans. Am. Nucl. Soc., 8: 258 (May 1965).

29552 CONTROL-ROD CALIBRATIONS AND SAMPLE-WORTH INTERACTIONS IN THE ARMF. E. E. Burdick, E. F. Aber, and D. W. Knight (Phillips Petroleum Co., Idaho Falls, Idaho). Trans. Am. Nucl. Soc., 8: 258-9(May 1965).

29553 THEORETICAL DEVELOPMENT OF STATISTICAL PRECISION LIMITATIONS FOR DIFFERENTIAL REACTIVITY MEASUREMENTS MADE WITH A SERVO-CONTROLLED REGULATION ROD. L. G. Cloud (Phillips Petroleum Co., Idaho Falls, Idaho). Trans. Am. Nucl. Soc., 8: 259-60(May 1965).

29554 DEFINITION OF SENSITIVITY FOR REACTIVITY MEASUREMENTS. W. E. Zagotta and W. E. Loewe (Illinois Inst. of Tech., Chicago). Trans. Am. Nucl. Soc., 8: 260(May 1965).

29555 PRECISION REACTIVITY MEASUREMENT FACILITY AT ARGONNE NATIONAL LABORATORY. R. C. Doerner (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 261-2(May 1965).

29556 THE RELIABILITY AND PHYSICAL INTERPRETATION OF MEASUREMENTS IN A REACTIVITY MEA-

SUREMENT FACILITY. S. B. Gunst, J. C. Connor, E. D. McGarry, and D. E. Conway (Westinghouse Electric Corp., West Mifflin, Pa.). Trans. Am. Nucl. Soc., 8: 262-3(May 1965).

29557 DETERMINATION OF RADIAL BUCKLING IN REFLECTED REACTORS. K. J. Serdula and R. E. Green (Atomic Energy of Canada Ltd., Chalk River, Ont.). Trans. Am. Nucl. Soc., 8: 264-5(May 1965).

29558 THE EFFECT OF TRANSVERSE BUCKLING ON THE DETERMINATION OF MATERIAL BUCKLINGS IN REFLECTED SYSTEMS. Henry H. Windsor (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 8: 265-6(May 1965).

29559 DETERMINATION OF K_∞ FOR A PuO_2–UO_2 GRAPHITE LATTICE. T. B. Thornbury and N. A. Hill (Battelle-Northwest, Richland, Wash.). Trans. Am. Nucl. Soc., 8: 268(May 1965).

29560 LINEAR RELATIONSHIP BETWEEN CADMIUM RATIO AND REACTOR CORE COMPOSITION. G. S. Stanford and K. E. Plumlee (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 270-1(May 1965).

29561 ASYMPTOTIC AND STEADY-STATE SPECTRUM MEASUREMENTS IN A MULTIPLYING MEDIUM. R. J. Cerbone, E. R. Gaerttner, and R. E. Slovacek (Rensselaer Polytechnic Inst., Troy, N. Y.). Trans. Am. Nucl. Soc., 8: 275-6(May 1965).

29562 MEASUREMENT OF REACTIVITY NEAR DELAYED CRITICAL BY THE PULSED-SOURCE METHOD. S. A. Scott and J. R. Wolberg (Technion–Israel Inst. of Tech., Haifa). Trans. Am. Nucl. Soc., 8: 278(May 1965).

29563 REACTOR LABORATORY EXPERIMENTS DEMONSTRATING DELAYED-NEUTRON EFFECTS ON AN OPERATING REACTOR. B. E. Leonard and R. T. Liner, Jr. (North Carolina State Coll., Raleigh). Trans. Am. Nucl. Soc., 8: 280-1(May 1965).

29564 STUDIES OF THE REACTIVITY WORTH OF CONTROL RODS IN FAR SUBCRITICAL ASSEMBLIES. B. K. Malaviya, I. Kaplan, D. D. Lanning, and T. J. Thompson (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nucl. Soc., 8: 282-3(May 1965).

29565 EFFECT OF CLAD ON DANCOFF FACTOR. Bal Raj Sehgal (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 8: 289-90(May 1965).

29566 EVEN-ORDER APPROXIMATIONS IN CRITICAL SIZE DETERMINATIONS. J. D. Callen and J. O. Mingle (Kansas State Univ., Manhattan). Trans. Am. Nucl. Soc., 8: 291(May 1965).

29567 TWO-DIMENSIONAL S_N PERTURBATION THEORY ANALYSIS. W. J. Fader, J. A. Loffreda, and E. L. Paradis (Pratt and Whitney Aircraft, Middletown, Conn.). Trans. Am. Nucl. Soc., 8: 295-6(May 1965).

29568 SPACE-DEPENDENT SPECTRUM MEASUREMENTS IN HEAVY-WATER-MODERATED LATTICES. Sagid Salah and T. F. Parkinson (Univ. of Florida, Gainesville). Trans. Am. Nucl. Soc., 8: 300(May 1965).

29569 THERMAL-ACTIVATION RATIOS IN LATTICES OF WATER AND SLIGHTLY ENRICHED URANIUM. J. J. Volpe (Westinghouse Electric Corp., West Mifflin, Pa.). Trans. Am. Nucl. Soc., 8: 301-2(May 1965).

29570 REACTION OF URANIUM WITH WATER IN TREAT MELTDOWN EXCURSION. Robert C. Liimatainen, Richard O. Ivins, and Frank J. Testa (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 306(May 1965).

29571 REACTOR-PLANT DYNAMICS DURING LOSS OF COOLANT. J. A. Redfield, and S. G. Margolis (Westinghouse Electric Corp., West Mifflin, Pa.). Trans. Am. Nucl. Soc., 8: 308(May 1965).

29572 ANALYTICAL MODEL FOR BLOWDOWN EXPERIMENTS. S. G. Margolis and J. A. Redfield (Westinghouse Electric Corp., West Mifflin, Pa.). Trans. Am. Nucl. Soc., 8: 308-9(May 1965).

29573 PRESSURE AMPLIFICATION AND THE ENERGY REQUIREMENTS OF THE SPERT-ID DESTRUCTIVE PRESSURE PULSE. R. W. Wright (TRW Space Technology Labs., Inc., Redondo Beach, Calif.). Trans. Am. Nucl. Soc., 8: 310(May 1965).

29574 FAST-REACTOR MELTDOWN ACCIDENTS WITH DOPPLER EFFECTS. R. A. Meyer, B. Wolfe, and N. Friedman (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 8: 310-11(May 1965).

29575 METHOD OF DETERMINING THE NEGATIVE REACTIVITY OF NEUTRONIC MULTIPLYING SYSTEMS. C. W. Ricker, A. L. Colomb, and E. R. Mann (to U. S. Atomic Energy Commission). U. S. Patent 3,188,470. June 8, 1965.

A method of measuring the negative reactivity of a subcritical nuclear reactor is provided. The amplitudes of several neutron fluctuation spectral densities are measured simultaneously and used to directly compute the value of negative reactivity. (AEC)

Design and Feasibility

29576 (BNL-9003) SETTLED-BED FAST REACTOR CONCEPT. Status Report. C. Raseman, J. Chernick, and L. P. Hatch (Brookhaven National Lab., Upton, N. Y.). [Feb. 25, 1965]. Contract [AT(30-2)-Gen-16]. 7p. (CONF-650602-21). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From American Nuclear Society 11th Annual Meeting, Gatlinburg, Tenn.

The Settled Bed Fast Reactor concept utilizes the advantages of a mobile fuel and maintains the many advantages of a solid fuel. This reactor concept consists of a core and blanket arranged as beds of small randomly packed fuel spheres. The work at Brookhaven has been directed toward maximizing the advantages of this concept and toward finding solutions to the associated problems. Research and development work to date has included studies of formation and stability of packed beds, investigations of fuel materials as well as reactor physics analysis, engineering design, thermal and hydraulic analysis, and a study of the system economics. A recent study of a 1000-Mw(e) design has shown that a Settled Bed Fast Reactor of this size is technically and economically feasible. (auth)

29577 (WAPD-LSBR-300) PERFORMANCE POTENTIAL OF LARGE SEED-BLANKET BREEDER REACTORS. (Bettis Atomic Power Lab., Pittsburgh, Pa.). Feb. 1965. Contract AT-11-1-GEN-14. 43p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

The California LSBR Plant is described briefly followed by a presentation of conceptual plant and reactor characteristics of a typical future 1000 Mw(e) central power station together with projected fuel utilization and economic performance data to show the potential future benefits obtainable from the development, construction, and operation of the Large Seed-Blanket Reactor proposed for the California Water Project. (L.B.S.)

29578 HEAVY-WATER REACTOR REVIEW AND PROSPECT. W. Bennett Lewis (Atomic Energy of Canada Ltd., Chalk River, Ont.). Trans. Am. Nucl. Soc., 8: 89 (May 1965).

29579 DESIGN APPROACHES FOR THE HEAVY-WATER ORGANIC-COOLED REACTOR PROJECT. J. R. Dietrich (Combusion Engineering, Windsor, Conn.), R. J. Rickert, and C. A. Trilling. Trans. Am. Nucl. Soc., 8: 89-90(May 1965).

29580 STEAM COOLING OF FAST REACTORS. J. H. MacMillan and D. C. Schluderberg (Babcock and Wilcox Co., Lynchburg, Va.). Trans. Am. Nucl. Soc., 8: 111-12 (May 1965).

29581 IMPROVEMENTS RELATING TO NUCLEAR REACTORS. John Michael Laithwaite, William George Hutchinson, and Leslie Charles Cole (to United Kingdom Atomic Energy Authority). British Patent 985,463. Mar. 10, 1965. Filed Oct. 17, 1962.

A reactor having a core cooled by a liquid coolant includes a core tank vessel housing the core and other separate tanks housing heat exchangers and coolant circulating means. Each heat exchanger has a coolant outlet and each circulating means has a coolant inlet open directly to the respective vessel interior. A top closure is provided for each tank vessel. Thermally insulating means surround the core and form with the core a free space. Outer ducts for each of the tank vessels connect the vessels with the space so that a mass of coolant liquid flows through the ducts and the space to form a coolant reservoir that is common to the space and the other vessels. The containment of the coolant reservoir constituted by the separate tanks and connecting ducts can be maintained at a substantially uniform temperature normally less than the temperature of the hot coolant leaving the core. The arrangement of ducting within the outer ducts reduces the number of penetrations through the tank vessel walls, and the interruptions below the liquid level are kept at a minimum. The number of outer ducts for the interconnection of separate tank vessels is reduced if the heat exchangers and circulating means are housed together instead of being accommodated separately. (B.L.M.)

29582 IMPROVEMENTS IN NUCLEAR REACTOR AND HEAT EXCHANGE UNITS. (to Babcock and Wilcox Co.). British Patent 986,489. Mar. 17, 1965. Priority date Aug. 22, 1960, United States.

A reactor is designed such that the reactor and heat exchange unit are contained in a vertically elongated upright pressure vessel. An upright, vertically elongated cylindrical baffle means is disposed within the pressure vessel and defines a passageway for the rise of heated pressurized fluid and a passageway for the downward return of cooled fluid. The reactor core is supported by the baffle means in the lower part of the riser passageway, and the heat exchanger is disposed in the downward passageway. The baffle means is supported from an upper part of the pressure vessel at an aperture adapted to permit removal of the baffle means and the core as a unit. (B.L.M.)

29583 HOMOGENEOUS BOILING NUCLEAR REACTOR. Olle Lindstroem (to Allmänna Svenska Elektriska Aktiebolaget). Canadian Patent 677,509. Jan. 7, 1964. Priority date Dec. 1, 1959, Sweden.

A boiling dispersion reactor is described in which a two-zone distribution is maintained within the pressure vessel. The outer zone acts as reflector while the inner zone contains a dispersion or solution of fissile and fertile material. An upwardly opening inner container that contains the boiling fuel is arranged substantially within a lower portion and in spaced relationship to the pressure vessel. A reflector chamber formed by the pressure vessel and the inner container receives the condensate of the boiling fuel vapor condensed in the heat exchanger means, and a pressure equalizing space is provided above and in communication with both the inner container and the reflector chamber. The level of the boiling fuel in the inner container and of the condensate in the reflector chamber are normally below the upper opening of the inner container. Means are provided for transferring the condensate through the plenum into the reflector chamber and from the reflector chamber to the inner chamber. (B.L.M.)

Fuels

Refer also to abstract 28514.

29584 (EUR-2184.e) THE TREATMENT OF SHAPED BURNABLE POISONS IN ANALOGUE BURN-UP CALCULATIONS. W. A. Raaijmakers (Reactor Centrum Nederland, The Hague (Netherlands)). 1965. 82p. Dep.(mn).

A review is presented of the calculational model employed in the study of shaped burnable poison particles and the depletion thereof. Also the overall effect on core behavior caused by such poisons in case they are incorporated into the fuel is given. This is done by making the appropriate modifications to an existing analog computer burnup program. A model is used in which the self-shielding factor becomes time-dependent, making assumptions which, however, may not turn out to be valid. (auth)

29585 (NP-14974) DEVELOPMENT OF A PHOTOGRAPHIC IDENTIFICATION SYSTEM FOR REACTOR FUEL ELEMENTS. Progress Report No. 1, December 1, 1963–June 1, 1964. James S. Mills (International Atomic Energy Agency, Vienna (Austria)). 10p. Dep.(mn).

A photographic identification system for reactor fuel elements has been designed and its components have been selected. The design is basically a photographic telemicroscope with an optical pipe for viewing below water surfaces. The measured resolution of the air path system was found to be about 0.8 sec of arc on photographic film. Identification techniques will be studied in great detail using both the telemicroscope and laboratory devices. For the purpose of establishing a fool-proof mark, corrosion studies must be made of the mark on fuel cladding metal surfaces. A corrosion loop has been designed and constructed for this purpose. Tests made to date are described and future work is outlined. (auth)

29586 TEMPERATURE DISTRIBUTIONS IN END CLOSURES OF ANNULAR FUEL ELEMENTS. Benjamin M. Ma (Iowa State Univ., Ames). Nucl. Struct. Eng., 1: 353-9(Apr. 1965).

The temperature distributions in bonded end closures of annular fuel elements, such as those often used in nuclear superheating power reactors, were determined analytically. The solution for the temperature distributions is represented by products of the Bessel functions with hyperbolic functions. An illustrative example is that for enriched uranium oxide and plutonium oxide (UO_2-PuO_2) fuel with Zircaloy-4 cladding and end closures in an inner (or central) superheating fast-reactor core. The assumed lengths of the end closure are 0.1, 0.5, 1.0, and 1.5 times the outer radius of the fuel element. The calculated results of the example indicated that the temperature distributions in the end closures approach constants as the lengths of the end closures increase. It was concluded that there is an optimum length of end closure for each fuel element design and that further increases in length waste the end-closure material. The temperature distribution in the thin end closures was approximately linear. To maintain the integrity of fuel elements, surface temperatures of cladding and end closures had to be kept appreciably below the known corrosion temperature limit of the coolant. (auth)

29587 DESIGN OF TRANSITIONS FOR CYLINDRICAL REACTOR FUEL ELEMENT END CAPS. Kenneth R. Merckx (Battelle-Northwest, Richland, Wash.). Nucl. Struct. Eng., 1: 360-7(Apr. 1965).

End closure design for reactor fuel elements must account for the transition in materials, geometry, and thermal conditions. A method of analysis and numerical results are presented, which apply to the designing of closures for cylindrical fuel elements. The significance and application to end cap design of the results of a series of parametric studies for bending and shear stresses in transitions having various heights, lengths, shapes, and thickness-to-radius ratios are discussed. (auth)

29588 IN-PILE MEASUREMENT OF URANIUM DIOXIDE FUEL-TEMPERATURE DISTRIBUTION. J. A. Christensen and R. J. Allio (Westinghouse Electric Co., Pittsburgh). Trans. Am. Nucl. Soc., 8: 40-1(May 1965).

29589 EXPERIMENTAL STUDIES OF TRANSIENT EFFECT IN FAST CERAMIC REACTOR MIXED-OXIDE (PuO_2–UO_2) FUELS. J. E. Hanson and J. H. Field (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 8: 42(May 1965).

29590 HYDRAULIC STUDIES WITH ORDERED PACKED BEDS. H. Susskind, W. Becker, and M. Maresca (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 8: 99-100(May 1965).

29591 THE BEHAVIOR OF COATED-PARTICLE FUELS IN A LARGE NUCLEAR TRANSIENT (KIWI-TNT).

W. U. Geer, C. G. Hoffman, and J. F. Ferrisk (Los Alamos Scientific Lab., N. Mex.). Trans. Am. Nucl. Soc., 8: 129-30(May 1965).

29592 MEASUREMENTS OF PROPERTIES OF URANIUM–ZIRCONIUM HYDRIDE FUEL IN A LARGE NUCLEAR TRANSIENT (KIWI-TNT). Laurence I. Moss (Atomics International, Canoga Park, Calif.), R. E. Forrester, and William T. Foremen. Trans. Am. Nucl. Soc., 8: 130-1(May 1965).

29593 METAL-WATER REACTIONS INITIATED BY A SHORT-PERIOD NUCLEAR REACTOR EXCURSION (KIWI-TNT). Robert C. Liimatainen, Richard O. Ivins, and Frank J. Testa (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 131-2(May 1965).

29594 CONTROLLING FACTORS IN DETERMINING FABRICATION COSTS OF METAL-CLAD OXIDE FUEL ELEMENTS. T. N. Washburn and D. A. Douglas (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 133(May 1965).

29595 A STUDY OF THE FUEL VALUE OF URANIUM-233. L. L. Bennett (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 133-4(May 1965).

29596 EFFECTS OF ATMOSPHERE ON BEHAVIOR OF FISSION PRODUCTS RELEASED BY IN-PILE MELTING OF UO_2. B. F. Roberts, W. E. Browning, Jr., R. P. Shields, and C. E. Miller, Jr. (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 139-4(May 1965).

29597 FUEL PROPERTIES AND NUCLEAR PERFORMANCE OF FAST REACTORS FUELED WITH MOLTEN CHLORIDES. P. A. Nelson, D. K. Butler, M. G. Chasanov, and D. Meneghetti (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 153-4(May 1964).

29598 FUEL BURNUP IN HETEROGENEOUS REACTOR LATTICES. C. G. Poncelet (Westinghouse Electric Co. Pittsburgh). Trans. Am. Nucl. Soc., 8: 208(May 1965).

29599 IMPACT OF ISOTOPE SALES ON FUEL CYCLE COSTS AND PRACTICES. J. A. Ransohoff. p.180-6 of "Proceedings [of the] Atomic Industrial Forum 1964 Annual Conference, November 30–December 3, San Francisco, California. Vol. 3." New York, Atomic Industrial Forum, Inc., 1965.

The potential effect of by-product isotope sales on fuel cycle costs and fuel management practices is reviewed. The fuel management practices, which may be affected by the proper consideration of isotope sales, include: overall planning of the fuel cycle, purchase or lease of fuel; sale or return of spent fuel and bred fuel; scheduling of fuel processing and fabrication; and optimization of fuel lifetime. Effects of ^{236}U, ^{237}Np, and ^{241}Am sales are considered. (M.C.G.)

29600 IMPROVEMENTS IN FUEL ELEMENT CANS FOR NUCLEAR REACTORS. Maurice Roy Slack, Christopher Cunningham, and Alan Marsh (to English Electric Co. Ltd.). British Patent 986,051. Mar. 17, 1965. Filed June 3, 1960.

A nuclear fuel element can having an extended heat transfer surface includes a plurality of fins on the outside of the can. The radial height of at least one of the fins varies from one point to another along the length of the can, and the height of all the fins is greater at the ends than at the middle. Longitudinal splitter fins extend substantially the entire length of the can and project radially outward beyond the helical fins. Circumferential brace members are spaced along the length of the splitter fins, and the radial height of the helical fins is increased adjacent and downstream of each brace member. (B.L.M.)

29601 FUEL ELEMENT CANS FOR GAS-COOLED NUCLEAR REACTORS. Maurice Roy Slack, Christopher Cunningham, and Alan Marsh (to English Electric Co., Ltd.). British Patent 986,052. Mar. 17, 1965. Filed June 3, 1960.

A nuclear fuel element can is described that has an extended heat transfer surface made up of a plurality of helical fins. The lead of the helix of the fins varies from one part of the can to another. This type of fuel element can avoids both relatively high temperatures at points on the can's surface that lead to overheating and relatively low temperatures that lead to reduced efficiency of heat transfer. (B.L.M.)

29602 NUCLEAR FUEL ELEMENT WITH CARBON JACKET. (to Siemens-Planiawerke Aktiengesellschaft für Kohlefabrikate). British Patent 986,939. Mar. 24, 1965. Priority date Mar. 21, 1961, Germany.

A carbon jacketed nuclear fuel element is described that affords an improved degree of impermeability to fission products at high temperatures, particularly above 500°C, without complicated cooling systems. The core of fuel material is surrounded by the jacket, which is intimately joined with the element core for retaining fission products. The jacket has at least two sealing zones around the core and one around the other. The sealing zones are in thermally conductive connection with each other and contain elemental carbon as a sealing agent. The plurality of sealing zones is particularly advantageous since each zone can be adapted to the specific stresses occurring at its particular location. Preferably, at least one of the sealing zones in the jacket consists of pyrolytic carbon. (B.L.M.)

29603 IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTORS. Ennemond Maillet (to Commissariat a l'Energie Atomique). British Patent 987,075. Mar. 24, 1965. Priority date Feb. 9, 1962, France.

A can and casing design is provided for a finned type fuel element in which the casing and can outline are specifically adapted to the helical flow of coolant around the element. A structure adapted to rigidly hold the element in place despite the stresses due to temperature fluctuations and radiation is provided. The inside surface of the casing and the outside surface of the can, which contains the rod of fissile or fertile material, together define a plurality of cooling gas ducts. Each duct is defined by the concave surface of the casing and at least one concave surface of the can. The concave surface of the can includes a set of fins extending longitudinally of the can. Each fin is oblique relative to the can axis. The concave surfaces serve to impart a helical flow to the gas moving along the duct defined by the surfaces. Means are provided for centering the can by engagement with casing parts between adjacent casing surfaces. (B.L.M.)

29604 IMPROVEMENTS IN OR RELATING TO GUIDE TUBES FOR NUCLEAR REACTOR FUEL ELEMENTS. Lucien Alfille, Claud Gewiss, and Jean Ropers (to Commissariat a l'Energie Atomique). British Patent 987,705. Mar. 31, 1965. Priority date May 2, 1961, France.

A composite guide tube for tubular fuel elements housed in a tube of a fluid-cooled reactor includes a central tubular element for guiding the fuel element and a metal structure having a low absolute density and at least partially covering the tubular element. The inner face of the structure is applied to the tubular element and the outer face abutts the inner face of the fuel tube. Means are provided for holding the structure on the tubular element, and means integral with the tubular element hold it in position in the fuel tube housing it. The ends of the central tubular element are made of steel. The structure at least partially covering the central tubular element is applied in the form of helically-wound strips, and the strips are welded together onto the element. The strips located in the hot zone of the reactor are made of stainless steel and those in the cold zone are of Zr or Zr alloy. (B.L.M.)

29605 NUCLEAR REACTOR FUEL ELEMENT WITH RADIALLY VARIABLE FUEL CONTENT. Raymond H. F. Marchal and René G. J. Cébélieu (to Société Nationale d'Etude et de Construction de Moteurs d'Aviation). Canadian Patent 678,995. Jan. 28, 1964. Priority date Dec. 11, 1959, France.

A reactor fuel element made up of a number of component parts that may be either rods or pencils arranged in a bundle or in concentric cylindrical rings is described in which the cross-sectional surface area of the parts is

constant. The active material concentration of the component parts increases from the exterior to the center of the element in such a way that the surface thermal flow is uniform. A minimum surface area of the can is provided, and thus, a solution to the problem of economy of neutrons is provided. (B.L.M.)

29606 NEUTRONIC REACTOR FUEL ELEMENTS ASSEMBLY. Hermann Kumpf and Hans Kroepfl (to Siemens-Schuckertwerke AG). Canadian Patent 680,821. Feb. 25, 1964. Priority date May 23, 1959, Germany.

In a fuel assembly for a heterogeneous type reactor, the plurality of elongated elements are arranged in a circular array with a plurality of substantially concentric undulated bands inserted between adjacent rows of fuel elements. The folds of the bands engage adjacent fuel elements so that each element is afforded lateral support; however, the ends of the elements are supported so that at least some of the elements are capable of relative longitudinal movement. A circumferential band surrounds the assembly adjacent to the undulating bands. Radially disposed stay-bolts are connected to the innermost undulated band and pass outwardly through the circumferential band. Tightening means coupled to the outer end of the stay-bolts engage the circumferential band and tighten it about the fuel assembly. (B.L.M.)

29607 FUEL ELEMENT FOR A NUCLEAR REACTOR. Ernst Bosshard (to Sulzer Frères, S. A.). Canadian Patent 684,827. Apr. 21, 1964. Priority date Mar. 15, 1960, Switzerland.

A fuel element is composed of an oblong can closed at one end and a plurality of tubes placed longitudinally of and inside the can in such a manner that spaces exist both between the tubes and between the tubes and the can. The tubes are made of a fissionable material, and a coolant flows through the tubes and through at least some of the spaces. The coolant flows through the tubes in opposite direction to that through the spaces, and the coolant flow is reversed at the closed end of the can. The fuel element may take the form of a tubular portion made of fissionable material placed within a corrosion resistant coat having ribs at the outside and longitudinal of the tube. The ribs of different tubes engage one another to form a tube package having a plurality of coolant passages extending the length of the package. A foot means made of a neutron flow reflecting material and connected to the outside of the closed end of the can includes means adapted to be engaged by means for transporting the can. (B.L.M.)

29608 THIMBLE PRESSURE PIPE FOR PRESSURE TUBE REACTORS. Hans-Peter Schabert and Horst Michael (to Siemens-Schuckertwerke AG). Canadian Patent 688,831. June 16, 1964. Priority date Nov. 3, 1960, Germany.

A design for a fuel element assembly is described in which the fuel rods or fissionable elements are positioned in the annular space between the outer pressure tube closed at the bottom and the coaxial inner tube of the thimble-type enclosure. The coolant is supplied centrally through the inner tube and discharged through the annular space. Since no fissionable rods are located in the inner tube, the self-shielding effect is slight. The relatively large annular space around the inner tube provides space for increasing the number of individual rods or particles per unit so that, for a given amount of fissionable substance, a considerable reduction in structural material is realized. If heavy water is used as a coolant, it acts additionally as a moderator in the interior of the fuel unit. The inner tube has a flange at its upper end, which serves to form a partition above the column of fuel elements and seals the annular space from the upper portion of the outer tube. (B.L.M.)

29609 FUEL ELEMENTS FOR USE IN NUCLEAR REACTORS. Jean Perilhou and Georges le Gargasson (to N. V. Philips' Gloeilampenfabrieken). Canadian Patent 690,135. July 7, 1964. Priority date Apr. 4, 1960, France.

A fuel element consists of a sheath in which the fissile material is provided in the form of compact bodies that are not in contact with the sheath. A coating of a refractory perforated material or a material in the form of a metallic refractory grating serve to separate the fuel and the sheath. The compact bodies may take the form of rings stacked on a central support, and the coating may be in the form of a very thin rigid coating that is held between nuts mounted on each end of the central support. (B.L.M.)

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Refer also to abstracts 28495, 28505, 28573, and 29578.

29610 (ACNP-64519(Rev.)) METHODS FOR CALCULATION OF THE ELK RIVER REACTOR FUEL INVENTORY. Marion L. Kennedy, Chieh Ho, and Edward D. Kendrick (Allis-Chalmers Mfg. Co., Bethesda, Md. Atomic Energy Div.). Feb. 15, 1965. Contract AT(11-1)-654. 19p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

An outline is presented of a simple procedure for maintaining the Elk River Reactor fuel inventory. The procedure includes methods for the whole core, for the regular and spiked elements, and for any other specific groups of elements. Examples are included for 8017.44 Mwd of heat generation. (D.L.C.)

29611 (AECL-1539) COMPUTER CONTROL OF NUCLEAR POWER PLANTS. Ernest Siddall (Atomic Energy of Canada Ltd., Chalk River (Ontario)). [1961]. 32p. Dep.(mn).

The advantages and disadvantages of multiple analog systems, the control computer, and the human being for the control of complex plants are reviewed. The nature of the reliability problem is outlined. The problems involved in complete control of a plant by a computer are studied, using the Douglas Point plant as an example and a guide. (auth)

29612 (AHSB(S)R-82) AN INVESTIGATION INTO THE TEMPERATURE VARIATIONS FOLLOWING A SINGLE-CHANNEL FIRE IN AN OPERATING CALDER REACTOR USING "DEMON" — A TWO-DIMENSIONAL MULTIPLANE COMPUTER PROGRAM. G. E. Betteridge and W. A. J. Wall (Authority Health and Safety Branch, United Kingdom Atomic Energy Authority, London (England)). 1965. 33p. Dep.; $0.80(BIS), 4s.(HMSO).

The application of a computer program is described in which a comprehensive two-dimensional representation in several axially spaced planes is used to investigate the flow of heat from a single channel fire to the surrounding channels in the core of any square-pitched Stage 1 reactor. Wigner energy is released from the intervening graphite moderator under the influence of simple annealing kinetics based on a constant activation energy, and this method has been compared with the simpler concept of reduced specific heats. The results show that a single channel fire in an operating Calder reactor should not spread to ignite the magnox in normal surrounding channels even when the graphite energy storage is much greater than that predicted on present theories for the projected twenty year life of this reactor. Some limitations of the reduced specific heat method are also demonstrated. (auth)

29613 (AP-Note-351) EFFECT OF RADIATION DAMAGE ON THE SERVICE LIFE OF THE SM-1A REACTOR VESSEL. H. R. Clayton and D. W. McLaughlin (Alco Products, Inc., Schenectady, N. Y. Nuclear Power Engineering Dept.). May 29, 1961. Contract AT(30-1)-2639. 23p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

A summary is given of the effects of radiation damage on the SM-1A reactor vessel and its service life. A brief general discussion of the radiation-caused rise in ductile-brittle transition temperature (NDT) and its effect on vessel operation is presented. To be consistent with previous radiation damage studies, the service life is first based upon the NDT at the midplane of the vessel. This is subsequently shown to be unnecessarily conservative due to

the rise in yield strength with irradiation and the high quality of the vessel material. A second calculation of service life more realistically based on NDT at the vessel nozzle indicates a vessel life of 210 megawatt years without annealing. Finally, a discussion of the possible extension of vessel life by periodic annealing is presented. (auth)

29614 (AP-Note-395) A STUDY OF POSSIBLE INCREASE OF INITIAL NDT IN THE SM-1 PRESSURE VESSEL WELD HEAT AFFECTED ZONE. H. R. Clayton (Alco Products, Inc., Schenectady, N. Y. Nuclear Power Engineering Dept.). Mar. 26, 1962. Contract AT(30-1)-2639. 34p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

The potential increase in initial nil-ductility transition temperature (NDT) in the weld heat affected zone of the SM-1 reactor vessel was initially studied by applying data on synthetic heat affected zones obtained in a prior investigation and using the SM-1 weldment conditions. The individual effects of heat input rate, base metal temperature, and plate thickness on the heat affected zone (HAZ) cooling rate were established from the available data. Results from application of this data to the SM-1 vessel welding conditions indicated that the heat affected zones in the longitudinal and girth welds may have suffered an NDT increase of up to 100 + °F with 70% probability that this occurred. A duplicate SM-1 weld test plate was produced and results analyzed using criteria derived from the prior investigation. One-half of the test plate remained in as-welded condition and one-half was stress relieved at 1150°F to duplicate SM-1 reactor vessel treatment. From microhardness tests and microstructure examination, it was estimated that the small medium-coarse grained areas within the SM-1 weld heat affected zone have increased 20 to 50°F in NDT above the base metal. These regions are less than 5% of the volume of the HAZ and are bounded by (1) weld metal, (2) by initially coarse grained regions which have been refined (normalized) by heat of subsequent adjacent weld beads, and (3) by intermediate to fine grained regions which were never heated to the grain coarsening temperature by the initial weld pass. Thus the net NDT of the heat affected zone is assumed no greater than the base metal and may be significantly less due to the general grain refinement of the heat affected zone as a whole. (auth)

29615 (AP-Note-427) FEASIBILITY STUDY FOR IN-PLACE ANNEALING OF THE PM-2A REACTOR VESSEL. E. Medal (Alco Products, Inc., Schenectady, N. Y. Nuclear Power Engineering Dept.). June 29, 1962. Contract AT-(30-1)-2639. 28p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

Studies of feasibility of annealing the PM-2A pressure vessel in place in order to reduce embrittlement of the vessel caused by irradiation resulted in selection of radiant heating as the most feasible method of annealing. Other possible methods of heating studied, using condensing steam, pressurized water, and hot gas, were less desirable. Advantages of the radiant heat method were: high annealing temperature (750°F) possible, atmospheric pressure, efficient use of heat where needed, controlled temperature distribution, minimum downtime, safety, and economy. A PM-2A pressure vessel mockup with a heater assembly to be installed in place of the thermal shield was designed for testing to determine axial temperature distribution at the vessel wall. The mockup testing would permit adjustment of the heating elements positioned opposite the vessel barrel wall, until the desired temperature distribution is attained. The same handling tool would be used as for the PM-2A thermal shield. Thermocouples to measure temperatures at several points on the reactor vessel wall and give remote indications for the heating assembly were designed and incorporated into the mockup. Calculations were made of temperature distributions axially through the pressure vessel wall. The reactor downtime for the annealing operations was estimated and the sequence of equipment installation and testing is given. (auth)

29616 (AP-Note-428) SM-1 IN-CORE FLOW AND TEMPERATURE MEASUREMENTS (TASK XIV). Status Report. F. G. Gebhardt and J. A. Christenson (Alco Products, Inc., Schenectady, N. Y. Nuclear Power Engineering Dept.). June 22, 1962. Contract AT(30-1)-2639. 81p. Dep.(mn); $3.00(cy), 2(mn) CFSTI.

A summary is presented of the present status of a test program to obtain in-core measurements of coolant flow and fuel plate temperature in the SM-1 reactor. Currently, all writing of testing procedures and hazards reports have been completed, and the equipment is ready for installation. (auth)

29617 (AP-Note-430) REPORT ON NATURAL CONVECTION CAPABILITY OF SM-1. P. L. Bradley (Alco Products, Inc., Schenectady, N. Y. Nuclear Power Engineering Dept.). July 11, 1962. Contract AT(30-1)-2639. 42p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

An investigation was made as to the feasibility of operating the SM-1 plant at low powers under the conditions of natural circulation. A steady state analysis using the STDY-3 code was performed and the results given. An analog model was developed to investigate primary loop stability with natural circulation. The ART-04 code was used to investigate the results of a rod withdrawal accident. (auth)

29618 (AP-Note-436) THERMAL STRESS EQUATIONS FOR PM-2A AND SM-1A REACTOR VESSEL MAIN COOLANT NOZZLES. B. J. Rowekamp (Alco Products, Inc., Schenectady, N. Y. Nuclear Power Engineering Dept.). June 18, 1962. Contract AT(30-1)-2639. 51p. Dep.(mn); $3.00(cy), 1(mn) CFSTI.

Equations are presented for use in the thermal stress analysis of PM-2A and SM-1A reactor vessel outlet and inlet nozzles. The equations define the discontinuity displacements and rotations that occur in the shell, reinforcement ring, and the nozzle itself. (D.L.C.)

29619 (AP-Note-437) RADIATION DAMAGE IN REACTOR VESSELS. SUMMARY STATUS REPORT AND BIBLIOGRAPHY FOR TASK 6. D. W. McLaughlin and B. J. Rowekamp (Alco Products, Inc., Schenectady, N. Y. Nuclear Power Engineering Dept.). June 22, 1962. Contract AT(30-1)-2639. 12p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

A summary is presented of the status and planned future work in the program for the definition of radiation damage and low-cycle fatigue problems in Army reactor vessels. The reports issued during the program are listed. (D.L.C.)

29620 (AP-Note-442) PROTOTYPE SKID-MOUNTED RADIOACTIVE LIQUID WASTE DISPOSAL SYSTEM. P. F. Santoro and O. P. Shellar (Alco Products, Inc., Schenectady, N. Y. Nuclear Power Engineering Dept.). July 3, 1962. Contract AT(30-1)-2639. 41p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

A description is given of the prototype skid-mounted radioactive liquid waste disposal system with sufficient detail about the process components and auxiliary systems and equipment to allow understanding of operating procedures. Operating procedures are provided to enable operation of the unit by NPFO personnel while processing radioactive liquid wastes at Ft. Belvoir. The present system incorporates four techniques of reducing liquid waste activity to MPC levels (1×10^{-7} μC/cc): neutralization and/or precipitation, centrifugation, evaporation, and demineralization. The four operations are discussed as an integrated system. A detailed procedure for operation of the hydroclones is included since this equipment was installed after the training program was conducted at Schenectady on operation of the system. Recommendations for modification to the present design which have arisen during fabrication and non-radioactive testing done at Alco-Schenectady, are included. (auth)

29621 (APDA-NTS-2) DETERMINATION OF CONTROL ROD FLOAT IN THE ENRICO FERMI REACTOR. R. E. Mueller and H. A. Wilbur (Atomic Power Development Associates, Inc., Detroit, Mich.). Nov. 1964. 46p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

Tests were conducted to detect control rod float in the Enrico Fermi reactor. Each of the seven installed safety rods and the two operating control rods was individually

tested, by means of subcritical nuclear measurements, to (1) confirm that safety rod floating does not occur at the primary sodium flow rate conditions that will exist in the reactor at Core A, 200-Mw(t) operation, and (2) to determine at what flow rate the control rods will float. The rods were also tested for floating at flow rates in excess of the Core A, 200-Mw(t) design value. None of the safety or control rods were observed to float at the Core A, 200-Mw(t) design value of 8.85×10^6 lb/hr. In the case of the safety rods, floating did not occur at flows up to 120 percent of the 200-Mw(t) design value. In the case of the two operating control rods, floating was observed when the flow was increased to approximately 107 percent of the 200-Mw(t) design flow. These rods were expected to float. During the course of this test, subcritical data were obtained which allowed preliminary evaluations to be made of the worth of the unshadowed safety rods and the shadowed operating control rods. An evaluation of the delatching spring compression of the two operating control rods was also made. These measurements were in good agreement with the predicted values. (auth)

29622 (CEA-R-2719) ETALONNAGE DES BARRES DE CONTROLE G.2/G.3 — HISTORIQUE ET METHODES. (Calibration of the G2/G3 Control Rods — History and Methods). Hubert Fenart (Commissariat à l'Energie Atomique, Chusclan (France). Centre de Production de Plutonium de Marcoule). Jan. 1965. 60p. Dep.(mn).

The various control rod calibrations which have been carried out on G2 and G3 since the inauguration of these reactors are described. The historical section is followed by a concise analysis of the various possible calibration methods, together with an example of the application of each of the methods used on G2 and G3. Finally some indications are given concerning the accuracy to be expected from these calibrations, as well as the best method applicable to these reactors. (auth)

29623 (CONF-446-80) HYPOTHETICAL FAST OXIDE REACTOR MELTDOWN ACCIDENT WITH DOPPLER EFFECT. B. Wolfe, N. Friedman, and R. Meyer (General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.). [1964]. Contract [AT(04-3)-189]. 4p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From American Nuclear Society 10th Annual Meeting, Philadelphia, June 1964.

The energy release from a meltdown accident in a 6000-liter fast reactor was obtained using a Bethe-Tait type calculation which takes into account a prompt negative temperature coefficient (Doppler effect) and permits the pressure-energy density relation to be approximated by a power series. A 1000-Mwe spherical reactor with PuO_2-UO_2 core was considered. Results of available explosive work are plotted as functions of reactivity ramp rate and Doppler effect. (M.J.T.)

29624 (COO-651-13) ELK RIVER REACTOR TWENTY-NINTH MONTHLY OPERATING REPORT, MARCH 1965. (Rural Cooperative Power Assn., Elk River, Minn.). Contract [AT(11-1)651]. 28p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

On March 1 the reactor was shut down to allow maintenance on the turbine governor. The governor control system was causing pressure surges in the secondary system that could have resulted in a reactor scram making the plant unreliable from an operational view. During the time required for the governor maintenance the down-time was utilized for technical specification tests and maintenance on other components of the nuclear plant. On March 5 the reactor and turbine were placed on the line and normal operation resumed at full power. Operation continued uninterrupted through the end of the month. At the end of the month the present operating run consisted of 26 continuous days which is the longest uninterrupted run to date. At this time, the next scheduled shutdown is May 15 for turbine-generator overhaul. (auth)

29625 (CVNA-219) CAROLINAS-VIRGINIA TUBE REACTOR POST-CONSTRUCTION RESEARCH AND DEVELOPMENT PROGRAM, TASK CVPC-22. STUDY OF PRIMARY SYSTEM PRESSURE DROPS. W. R. Snyder (Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.). May 1965. Contract AT(30-1)-2289. 39p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

The results of work performed to date for the purpose of comparing the calculated CVTR Primary Coolant System pressure drops with measured values are reported. (auth)

29626 (CVNA-221) ANALYSIS OF THE CVTR POST-CONSTRUCTION THERMAL AND HYDRAULIC DATA. R. O. Sandberg and A. A. Bishop (Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.). May 1965. Contract AT(30-1)-2289. 45p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

Post-construction steady state operating data obtained from the CVTR core were analyzed and compared with the thermal and hydraulic design criteria as summarized in CVNA-95 and CVNA-115. The results of this study indicate that the core can be operated on a continuous basis at 44.3 Mw, and that operation at a significantly higher power level appears feasible without exceeding upper design limits. (auth)

29627 (CVNA-228) CAROLINAS VIRGINIA NUCLEAR POWER ASSOCIATES, INC. RESEARCH AND DEVELOPMENT PROGRAM. Quarterly Progress Report, July–September 1964. (Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.). Contract AT(30-1)-2289. 114p. Dep.(mn); $4.00(cy), 2(mn) CFSTI.

A study was started to determine the capability of the plant to operate at an increased power level. Results of preliminary work indicate that a power level of 65 Mw can be achieved. The reactor appears to be safe under the major accident conditions of loss of coolant, loss of flow and rod withdrawal. Work is continuing on the thermal and hydraulic analyses, determination of fission gas release, determination of the burnup that can be achieved with the fuel, and prediction of the variations in the radial peaking factor with burnup and control rod patterns. Analytical results indicated that fluorides were present in the moderator, however, subsequent work led to the conclusion that peroxide is an interference in the determinations and that virtually no fluoride is present. (J.R.D.)

29628 (CVNA-229) MONTHLY OPERATING REPORT, JANUARY 1965. (Carolinas Virginia Nuclear Power Associates, Inc., Parr, S. C.). 31p. Dep.(mn) $2.00(cy), 1(mn) CFSTI.

Operation of the reactor continued under automatic control at essentially full licensed power during the month of January. Two scrams occurred; one on January 7 and the other on January 31, 1965. The first was due to a loss of the 480 volt line at the Parr Steam Plant. The subsequent loss of the generator field led to a turbine trip scram. As a result of this condition, the generator was shutdown for nearly thirty hours due principally to necessary repair work at the Parr Steam Plant. During this outage the vapor container was entered briefly to perform maintenance work on the flux wire system. The second scram was due to a false signal on NIC-4, that resulted in a reactor fast period scram. The reactor was started up and the generator was placed back on the line approximately eight hours later after necessary corrective maintenance was performed. The generator was on the line for 704.5 hours during the month, and the gross electrical generation was 7,187,000 Kwhe. The availability factor was 97.8%. Routine and special maintenance, chemistry and health physics work was performed in support of plant operation and shutdown. Several engineering problems were completed. Heavy and light water systems chemistry generally remained within specifications during the month, although the Primary Coolant particulate concentration (crud level) was observed to increase after each scram. No unusual radiological problems were observed as a result of plant operation, or the shutdowns. (auth)

29629 (CVNA-231) MONTHLY OPERATING REPORT, MARCH 1965. (Carolinas Virginia Nuclear Power Associates, Inc., Parr, S. C.). Contract AT(30-1)-2289. 37p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

The reactor was shutdown during the first three weeks of the month for a scheduled maintenance outage. Relatively high airborne tritium and radiation levels were encountered as a result of the shutdown work, particularly, in the reactor Header Cavity. However, the radiation doses incurred by plant personnel were maintained well within permissible limits. On March 22, the reactor was started back up and two physics tests were completed. Several problems interrupted reactor operations during the last part of the month. (auth)

29630 (CVNA-234) MONTHLY OPERATING REPORT, APRIL 1965. (Carolinas Virginia Nuclear Power Associates, Inc., Parr, S. C.). Contract AT(30-1)-2289. 30p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

The reactor was started up on April 8, 1965, after being shutdown since March 31, 1965, for repairs and reactor operation continued through the end of the month. S.U. CV-87, the "High pD Test for CVTR," was begun on April 25th and will continue into May. The Reactor Safety Committee, AEC Division of Compliance Inspectors and personnel from Atomics International visited the site during the month. Additional information was prepared and submitted to the AEC in support of the pending 65 MW license application for the CVTR. (auth)

29631 (DLCS-5001264) MONTHLY OPERATING REPORT [ON PWR OPERATIONS], DECEMBER 1964. (Duquesne Light Co., Shippingport, Pa.). Contract AT(11-1)-292. 35p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

The significant operations, occurrences, and other activities of the Shippingport Atomic Power Station are reported for December 1964. Modification of the Reactor Plant for Core 2 operation and the overall refueling operation continued. Reference water conditions were maintained in the Coolant Charging and Canal Water Systems. The Reactor Coolant System pH was below the specifications for wet lay up, however, a chemical addition of lithium hydroxide restored the system to prescribed pH limits. There were no unusual occurrences of contamination in the Station and all personnel radiation exposures were within specified limits. The M-130 fuel shipping container was loaded with PWR-1 fuel blanket and seed assemblies and shipped to the Expended Core Facility. Hydrostatic tests were performed on the PWR-2 mechanism component cooling water system, and for the examination of all seal welds on the reactor vessel components. Twelve tests were performed in December, five of which were completed, and seven were in progress at the end of this report period. Twelve test procedures and eight preliminary reports were issued during the month. Training of operations personnel for Core 2 operations continued throughout December. During this period, three additional Station Operating Supervisors and seven station operators were certified by AEC for Core 2 operations. Construction of the new visitors' building was started in December. Eight of the 27 minor modifications in progress during the month were completed. (auth)

29632 (EUR-1849.e) ANALYSIS OF NEUTRON SPECTRUM IN CANDU-TYPE LATTICE. H. Takahashi (European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center). 1964. 22p. Dep.(mn).

Neutron spectra in CANDU type lattice are analyzed by the first flight collision probability (F.F.C.P.) method, using the free gas model, the Brown-St. John's model and the Nelkin–Honeck's model for the neutron scattering by D_2O. Applicability of F.F.C.P. method to a loosed lattice such as the CANDU lattice is firstly discussed, it is shown from the comparison of various scattering models that the chemical binding plays a very important role in analysis of the neutron spectrum of this type reactor, and the effective mass approximation for the chemical binding can not be applied, and that the neutron spectrum in fuel region in epithermal energy around 0.2 ev is quite sensitive to the scattering model. The effect of neutron slowing down on the hardening of neutron spectrum in fuel region is larger than the effect of the rethermalization (heating of neutron by hot coolant). Comparison of the calculated values of reaction rate with the experimental results of Bigham et al. shows that the agreement of two results in cold coolant is very good in the activation ratio of Lu-176 to Mn-55, but not in the case of hot coolant. The agreement of experimental and calculated values of fission ratios of Pu-239 to U-235 is rather good in hot coolant case but not in the cold coolant case. (auth)

29633 (EUR-2116.f) ETUDE DE LA ZONE OPTIMALE DES PARAMETRES INDEPENDANTS D'UN REACTEUR ORGEL ASSOCIE A UNE CENTRALE DE 250 MWeb. ELEMENTS COMBUSTIBLES EN CARBURE D'URANIUM NATUREL LEGEREMENT ENRICHI—GRAPPE A 7 CRAYONS, GAINAGE EN SAP. (Study of the Optimum Zone of the Independent Variables of an ORGEL-Reactor Connected to a 250 MWeb Power Plant. Slightly-Enriched Natural Uranium Carbide Fuel Elements—Bundle of 7 Rods, SAP Cladding). B. Haijtink, F. Lafontaine, and P. Tauch (European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center). 1965. 34p. Dep.(mn).

The description is given of the optimum zone of the independent variables of an ORGEL-reactor connected to a 250 MWeb power plant. These independent variables determine the geometry of the fuel elements (7 rods type UC, SAP clad), the geometry of the core and the operating conditions of the plant. A slight enrichment raises very sensibly the economic interest of an ORGEL-type power plant. Compared to a natural uranium fuelled ORGEL plant, such a conceptional modification decreases the specific investment in D_2O by 50%, whereas the burn-up of the fuel elements is doubled. Hence the energy extracted per gram of fissile material doubles; the fuel depletion and the plutonium production in the irradiated fuel elements is increased. Such a modification of the fuel material conception allows the realization of a gain in the order of 0.8 mills/kwh in the cost of energy production. (auth)

29634 (EUR-2244.e) RECENT OPTIMIZATION METHODS. W. Boettcher, F. Lafontaine, and P. Tauch (European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center). 1965. 22p. Dep.(mn).

An outline is given of the optimization techniques used for the ORGEL reactor power plant design. A computer code, ORION II, developed by the ORGEL Project Group, describes the mathematical model of the plant and calculates the minimum power generating cost in function of up to 8 independent variables and up to 3 linear constraints. Total power generating cost is expressed in terms of a second degree function of the eight independent variables, an approximation which proved to be satisfactory (error smaller than 1%). An example shows the advantages of an overall optimization on the total energy production cost. (auth)

29635 (EUR-2412.e) MATERIAL BALANCES IN NUCLEAR ENERGY. G. Ritter and G. Blaesser (European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center). 1965. 20p. Dep.(mn).

It is felt that one should not only judge the potential of reactor types by their constructional features and peculiarities or by the comparison of the electricity generating costs at the present situation but that a long-term nuclear program should also be based on a thorough study of the complete material balances for the different types of systems. From the point of view of fuel conservation, fast breeders and advanced thermal thorium converters are shown to be preferable by orders of magnitude to the more conventional light water, heavy water, and graphite-gas reactors. (auth)

29636 (GAMD-2309) EBOR CORE ELEMENT TEMPERATURES FOLLOWING A LOSS-OF-COOLANT ACCIDENT. R. Katz (General Atomic, San Diego, Calif.). June 8, 1961. Contract AT(04-3)-187. 61p. Dep.(mn); $3.00(cy), 2(mn) CFSTI.

Analysis is developed for determining the temperatures of the EBOR core element following a loss-of-coolant accident. The governing equations form a set of simultaneous, first order, non-linear, differential equations which are solved numerically by means of a code (LOCO) written for the IBM-7090. The basic analytical model of

the core element considers each of the component bodies to be represented by an average temperature. Results of the basic model are compared with an improved model based on subdividing the fuel and moderator components into three equal parts in order to approximate the internal temperature distribution. The basic model was found to give somewhat more conservative results as regards the magnitude of the cladding temperature. The cladding temperature is of most interest for the loss-of-coolant accident. The general characteristics of the cladding temperature are similar in all cases investigated namely, the cladding temperature increases to a peak value at approximately 10 seconds, then goes through a minimum, thereafter increases at a nearly constant rate. For time intervals after the loss-of-coolant accident greater than approximately 900 seconds, the cladding temperature can be estimated by assuming all the bodies are at the same temperature and equating the increase of heat content of the bodies to the integrated power generation. The effect on the cladding temperature of a 0.002″ radial, helium-filled gap (Case I) and a perfect thermal contact (Case II) between the fuel body and cladding was investigated. The peak cladding temperature at 10 seconds based on Case II was greater than that based on Case I, however, it was concluded that the results of Case I are more physically realistic. The effect of an external air and helium environment was investigated. With a helium environment, the dominant mode of heat transfer was by conduction and radiation was negligible, therefore, any error in the results due to uncertainties in the assumed emissivities is also negligible. With an air environment, the magnitude of the peak cladding temperature at 10 seconds was greater than with a helium environment and radiation is more significant. The results for air are to be expected because of the large difference between the thermal conductivity of air and helium. Decreasing the radial gap between the shroud and square-annular moderator was found to considerably reduce the peak cladding temperature at 10 seconds and also the temperature at long time intervals. The magnitude of the initial temperatures has a significant effect on the cladding temperature following the loss-of-coolant accident. In particular, the maximum cladding temperature for a time interval less than 900 seconds was found to occur at the point of the initial maximum cladding temperature rather than the point of maximum power generation. (auth)

29637 (GAMD-5277) APPLICATION OF THE TARGET CODE TO THE 1000-Mw(e) VESSEL PRELIMINARY DESIGN. C. Riparbelli (General Atomic, San Diego, Calif.). Nov. 25, 1964. Contract AT(04-3)-167. 45p. Dep.(mn).

The IBM program TARGET is used in order to obtain deformation-analysis solutions for a prestressed-concrete structure of a 1000-Mwe nuclear power plant. (T.F.H.)

29638 (GAMD-6145) ADVANCED HTGR FUEL ELEMENT VIBRATION TESTS. R. J. Kiefer and T. R. Sparks (General Atomic, San Diego, Calif.). Dec. 29, 1964. Contract AT(04-3)-167. 34p. Dec.(mn); $2.00(cy), 1(mn) CFSTI.

Resonant frequencies and their amplitudes were measured on the large HTGR fuel element. A variety of methods were used to induce vibrations. Results were compared to calculated values of the natural frequencies and the amplitudes were compared to mathematical expressions derived by other investigators for flow induced vibrations. (auth)

29639 (GEAP-4772) EVESR-NUCLEAR SUPERHEAT FUEL DEVELOPMENT PROJECT. DARE CODE FOR THE THERMAL HYDRAULIC FUEL PERFORMANCE EVALUATION. B. G. Atraz (General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.). Jan. 1965. Contract AT(04-3)-189. 395p. Dep.(mn); $7.00(cy), 7(mn) CFSTI.

The DARE code for thermal hydraulic fuel performance evaluation for the ESADA-VESR facility is described. Problems associated with the development of nuclear superheat fuel are stress corrosion cracking of the clad material, strain cycle fatigue in the clad material, and contamination carry-over. Main variables for the analysis are fuel cladding materials, cladding operating temperatures, and cladding strain levels. Operating conditions in the fuel bundles are determined by a code, using as input the pressure, temperature, and flow rate. The EVESR irradiation test procedure, data reduction and retrieval, the DARE code and code tapes, the EVESR instrumentation, and the DARE code options and functions are summarized. Features of the DARE code option input descriptions, symbol lists, and output descriptions are presented. (M.J.T.)

29640 (GEAP-4842) DEVELOPMENT PROGRAM ON THE GARIGLIANO NUCLEAR REACTOR. Quarterly Report No. 10. C. L. Howard (General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.). Apr. 1, 1965. Work Performed under United States-Euratom Joint Research and Development Program. Contract AT-(04-3)-189. 30p. (EURAEC-1373). Dep.(mn); $2.00(cy), 1(mn) CFSTI.

Programming for the SENN on-line computer has been completed, and the programs are being tested at the reactor site. Computer installation also has been completed. The program for on-line calculation of the neutron flux distribution has been tested, using better albedo values, and was found to give good results. A minor change in the procedure for usage of the 80 in-core ion chambers gives further improvement. The instrumentation for the four instrumented assemblies is being fabricated. Use of movable ion chambers adjacent to the corners of the instrumented fuel assemblies has been approved by SENN, and detail design is in progress. A different method of measuring power distribution in irradiated fuel has been proposed, and equipment is being designed. The method uses the D_2O (γ,n) reaction and measurement of the resulting neutrons to obtain the profile of La-140 activity in the fuel. Additional safeguards data have been submitted to SENN for use in obtaining CNEN approval for the reactor tests. The control rod oscillator equipment has been assembled, and is being tested in San Jose. The stability pre-test analysis has been slightly to use the best estimates of recirculation flow and inlet subcooling. SENN is in the process of being nationalized. The responsibilities of SENN in the Development Program will be assumed by ENEL. (auth)

29641 (HW-84544(App.4)) CALCULATED REACTOR PARAMETERS FOR THE HIGH POWER DENSITY CORE IN PRTR, APPENDIX IV. R. I. Smith and J. L. Maryott (General Electric Co., Richland, Wash. Hanford Atomic Products Operation). Dec. 3, 1964. Contract AT(45-1)-1350. 7p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Calculations were performed to obtain estimates of the reactivity transients due to fission product poisoning which would be expected in the high power density core with the reactor operating at various power levels and with or without boron in the moderator. The method of calculation and the results are presented. (L.B.S.)

29642 (IDO-28641) ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM. Quarterly Progress Report, October 1-December 1964. (Aerojet-General Nucleonics, San Ramon, Calif.). Feb. 15, 1965. Contract AT(10-1)-880. 90p. Dep.; $3.00(cy), 2(mn) CFSTI.

The technical progress of the Army Gas-Cooled Reactor Systems Program to develop a mobile, low-power, nuclear power plant for Military field operation is summarized. The ML-1 power plant was operated for 1509.53 hr during the report period; the overall on-stream factor was 68.36%. The thermodynamic performance test, several shielding evaluation experiments and a preliminary afterheat evaluation experiment were completed. Analysis of the thermodynamic test data indicates the net power plant output was about 30 kw less than during earlier runs. Tests to evaluate the stability and lifetime of CSN-1A type bearings were initiated. The final design of the improved ML-1 precooler was approved and fabrication of this unit was initiated in the vendor's shop. The fabrication of the 600 kw alternator was ini-

tiated and the gear set for use with the alternator was delivered. Metallurgical evaluation of the IB-17R-2 test element was completed. The in-pile test of a prototype of the ML-1-II fuel element (IB-17R-3) was terminated after 9501 hr of operation; fission product activity in the test loop indicated the possibility of cladding failure. The initiation of fabrication of the ML-1-II core loading was delayed pending investigation of the IB-17R-3 failure. Under the ML-1 Technology program, the evaluation of Hastelloy X cladding continued and a program to define the limits of the existing pressure vessel technology was initiated. A shielding optimization study to supplement the ML-1A Preliminary Design was begun. Modification of the GCRE facility continued; completion of this work is scheduled for March 1965. (auth)

29643 (LA-DC-6889) THE ROLE OF NONDESTRUCTIVE TESTING IN THE LOS ALAMOS REACTOR PROGRAM. Gerold H. Tenney (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1964]. Contract W-7405-eng-36. 31p. (CONF-650509-2). Dep.(mn); $2.00(cy), 1(mn) CFSTI.

From IAEA Symposium on Nondestructive Testing in Nuclear Technology, Bucharest.

Some of the unique nondestructive testing techniques and applications developed for and used in the reactor program are described. LAPRE (Los Alamos Power Reactor Experiment) was based on the use of a uranium phosphate solution at high temperature. This solution is very corrosive, and all reactor parts in contact with it were clad with gold. Special radiographic techniques were used to inspect the gold during the process of rolling it from cast ingot into sheet. The welded seams were similarly inspected. An electrode-potential inspection method was developed for checking the gold surfaces for embedded impurities. The fundamental concept of LAMPRE (Los Alamos Molten Plutonium Reactor Experiment) is the use of liquid—rather than solid—plutonium metal as fuel. Tantalum capsules contained the fuel. Novel nondestructive testing methods were used to check the soundness of base metal and welds during the production of the capsules, and to study the plutonium-loaded capsules before, during, and after melt-freeze tests. A molten plutonium pump experiment was observed by radiographic techniques, including a gamma-ray closed television circuit. For UHTREX (Ultra High Temperature Reactor Experiment), now under construction, microradiographic and electron microscopic studies have been made on 350-micron-diameter pyrocarbon-coated uranium carbide beads, to evaluate uranium migration as a function of temperature. The amount and uniformity of the uranium loading in the UHTREX graphite elements are determined with specially designed scintillation counters. (auth)

29644 (NAA-SR-10154) ANALYSIS OF TEMPERATURE OSCILLATIONS IN THE SRE. C. L. Peckinpaugh (Atomics International, Canoga Park, Calif.). Apr. 20, 1965. Contract AT(11-1)-Gen-8. 25p. Dep.; $2.00(cy), 1(mn) CFSTI.

Movement of the fuel rod bundle in its coolant channel caused large fuel element temperature oscillations in the second core of the SRE. Detail analysis of test data indicated that this movement was a horizontal thermal bowing of the fuel cluster caused by temperature differences and associated differential thermal expansion across the rod bundle. Based on this experimental information, a theoretical model was developed which contains a central fuel region with isolated coolant regions on each side. The fuel was forced to move horizontally back and forth sinusoidally at 0.5 cps, which corresponds to the frequency of oscillation predominantly observed. In the model, changes in the coolant flow rate caused by oscillating flow area were determined by frictional pressure-drop relationships. In addition, the increasing and decreasing channel volume caused an alternating acceleration and deceleration of coolant axially up the coolant channel, i.e., a pumping action. The resulting coolant and fuel temperature oscillations were calculated by using standard heat balance and heat transfer equations. The results from the theoretical model were in good agreement with the measured values, and clearly indicated that an unstable condition existed and that sustained oscillations would result. The model fully describes all major oscillation characteristics and provides a full understanding of how and why the fuel movement and associated temperature oscillations occurred. (auth)

29645 (NAA-SR-10817) SRE MARK II FUEL HANDLING MACHINE. H. B. Dietz (Atomics International, Canoga Park, Calif.). Apr. 20, 1965. Contract AT-11-1-GEN-8. 80p. Dep.; $3.00(cy), 2(mn) CFSTI.

The Sodium Reactor Experiment Mark II fuel handling machine has been modified to ensure fuel and gas containment during core III operation. A new control system has been designed for the fuel handling machine. The design, operation, and hazard aspects of the fuel handling machine are discussed. It is concluded that the fuel handling machine will safely and reliably handle SRE core III fuel. (auth)

29646 (NP-14617) COMBINATION SEA WATER DESALTING AND ELECTRIC POWER PLANT FOR ISRAEL. (Joint United States–Israel Power and Desalting Team). Oct. 1964. 134p.

The economics of a dual-purpose electricity-desalination nuclear power reactor for use in Israel beginning about 1971 is analyzed. The concept studied employs flash distillation for desalination. (T.F.H.)

29647 (ORNL-P-1151) FACTORS AFFECTING ANALYSIS OF DUAL-PURPOSE DESALINATION PLANTS. C. C. Burwell, R. A. Ebel, and R. P. Hammond (Oak Ridge National Lab., Tenn.). [nd]. Contract [W-7405-eng-26]. 30p. (CONF-650420-1). Dep.(mn); $2.00(cy), 1(mn) CFSTI.

From 5th Panel Meeting on Use of Nuclear Energy in Saline Water Conversion, Vienna.

The advent of nuclear desalting stations will make possible an important new source of water from the sea. In each situation, however, it is important to determine how the proposed plant compares with alternative methods of supplying the needed water, and to optimize the plant design to fit the local needs. Some of the analytical tools and techniques that can be applied to these tasks are discussed. In the case of the dual-purpose plant producing power as well as water, the cost of steam must be allocated appropriately to the two products. Although this is a purely arbitrary choice, a method is presented which has the novel feature of apportioning heat cost so that neither water nor power cost is appreciably affected by changing the product ratio of the plant design. Although simple analytical models can assist in characterizing desalination plant systems, the details of design and optimization are greatly aided by computer techniques. The computer codes in use at the Oak Ridge National Laboratory for desalination studies are listed, and illustrated by examples. (auth)

29648 (ORNL-TM-1057) ESTIMATION OF ANNUAL OPERATING AND MAINTENANCE COSTS OF DUAL-PURPOSE NUCLEAR-ELECTRIC SEA WATER CONVERSION STATIONS. S. A. Reed and J. C. Moyers (Oak Ridge National Lab., Tenn.). Apr. 1965. Contract W-7405-eng-26. 12p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Estimates of the operating and maintenance costs of dual-output nuclear desalination plants are presented, based on projected manpower requirements, supplies, and maintenance materials for base-load stations having 90% plant factor. Two multistage flash evaporator plants have been considered; a 165×10^6 gpd plant coupled to a 3220 Mw(t) nuclear-electric plant powered by a pressurized water reactor, and a 10^9 gpd evaporator plant operated with a 25,000 Mw(t) nuclear-electric plant which was powered by three pressure tube reactors. (auth)

29649 (PB-181694) PARAMETRIC COST STUDIES PERTAINING TO DUAL-PURPOSE POWER AND WATER DESALINATION PLANTS. Research and Development Progress Report No. 109. L. Stone, F. J. Patti, M. E.

Knebel, W. G. Gerber, M. Zizza, and S. Baron (Burns and Roe, Inc., New York). [1963]. 103p. $2.75(CFSTI).

Three related studies are carried out: determination of the design and costs of dual-purpose sea-water desalination-electricity nuclear power plants with outputs of 7 to 50 MGD; minimum costs of desalination without power production in 40-Mwt nuclear reactors; and minimum costs of desalination without power production in conventional plants having outputs of 1 to 14 MGD. Multistage flash evaporation is the desalination mechanism used in each case, and the desalination is carried out to the level at which the water is potable. (T.F.H.)

29650 (WAPD-SC-501(Del.)) PWR CORE-2 SAFETY ANALYSIS. (Bettis Atomic Power Lab., Pittsburgh, Pa.). June 1964. Contract AT(11-1)-Gen-14. 76p. Dep.(mn); $3.00(cy), 2(mn) CFSTI.

An analysis is made to insure that the maximum plausible accident as applied to Core 2 operation does not present an unacceptable potential hazard to the public. All credible accident situations have been evaluated and it is concluded that operation of the Shippingport Atomic Power Station with Core 2 will not pose an unacceptable hazard to the environment. Core 2 was developed to demonstrate higher performance in terms of power density, power capability, and core lifetime than Core 1. Despite higher performance, thermal margin equal to Core 1 is obtained through zoning of fuel concentrations and increased coolant flow. Because of the greater design lifetime than Core 1, higher inventories of fission products and decay heat will exist in Core 2. Improvements in the safety injection system protect against fission product release by assuring that there will be no meltdown of the core in the unlikely event of a loss-of-coolant accident. (auth)

29651 (WCAP-3269-3) LARGE CLOSED-CYCLE WATER REACTOR RESEARCH AND DEVELOPMENT PROGRAM. Progress Report, April 1–June 30, 1964. (Westinghouse Electric Co., Pittsburgh, Pa. Atomic Power Div.). Contract AT(30-1)-3269. 230p. Dep.(mn); $6.00(cy), 5(mn) CFSTI.

Research and development are reported on reactor physics, reactor core design, chemical shimming, reactor plant engineering, reactor safeguards, and reactor criticality. (J.R.D.)

29652 A HIGH TEMPERATURE REMOTE PULSE PREAMPLIFIER SYSTEM FOR REACTOR STARTUP CHANNELS. R. E. McLain and L. S. Beller (Atomics International, Canoga Park, Calif.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 361-5(Feb. 1965).

A remotely located pulse preamplifier and a neutron detector-preamplifier coupling network developed for startup channels of the Hallam Power Reactor are described. (D.C.W.)

29653 SOME EXPERIENCES IN THE OPERATION OF NUCLEAR POWER STATIONS. R. J. Weeks (Central Electricity Generating Board, Bradwell on Sea, Eng.). Neue Tech., 7: 62-7(Apr. 1965).

Experiences gained in the operation of the first two natural uranium gas-cooled graphite-moderated reactor power stations of the United Kingdom Central Electricity Generating Board are reviewed. Details are given of electrical generation over the period under review, together with routine operating experiences, including performance limits, statutory regulations and the handling of new and used fuel. Reference is made to causes of loss of availability, the way in which these were dealt with, and the improvements that were made. (auth)

29654 DETERMINATION OF BURNUP OF EBR-II FUEL. R. P. Larsen (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 8(May 1965).

29655 MONITORING REACTOR POWER BY N-17 NEUTRON DECAY. S. A. Scott (Technion–Israel Inst. of Tech., Haifa) and A. Notea. Trans. Am. Nucl. Soc., 8: 9(May 1965).

29656 FUEL MANAGEMENT IN STEAM-GENERATING HEAVY-WATER REACTORS. D. Hicks (United Kingdom Atomic Energy Authority, Winfrith, Dorset, Eng.). Trans. Am. Nucl. Soc., 8: 91(May 1965).

29657 URANIUM OXIDE TUBES FOR D_2O POWER REACTORS — PROJECTED ECONOMICS AND REACTOR PERFORMANCE. R. R. Hood (E. I. du Pont de Nemours and Co., Wilmington, Del.). Trans. Am. Nucl. Soc., 8: 91-2(May 1965).

29658 HEAVY-WATER-GAS-COOLED REACTORS AND THE FRENCH PROGRAM. R. Naudet (Commissariat a l'Energie Atomique, Saclay, France). Trans. Am. Nucl. Soc., 8: 92(May 1965).

29659 CORRELATION OF THE EFFECTIVE FUEL-PELLET TEMPERATURE FOR THE DOPPLER BROADENING OF U-238 RESONANCE. William T. Sha (Westinghouse Electric Co., Pittsburgh). Trans. Am. Nucl. Soc., 8: 98-9(May 1965).

29660 A THEORETICAL MODEL DESCRIBING FUEL-ELEMENT TEMPERATURE OSCILLATIONS IN SRE CORE II. C. L. Peckinpaugh and H. H. Cappel (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 8: 99 (May 1965).

29661 SUMMARY OF THE NUCLEAR BEHAVIOR OF THE PM-3A NUCLEAR POWER PLANT. J. C. Scarborough (Nuclear Utility Services, Washington, D. C.) and T. L. Boennighausen. Trans. Am. Nucl. Soc., 8: 101-3 (May 1965).

29662 RADIOLOGICAL CONTROL MODIFICATION AT THE SM-1. J. T. Miller and F. P. Schauer (Army Nuclear Power Field Office, Fort Belvoir, Va.). Trans. Am. Nucl. Soc., 8: 103(May 1965).

29663 EVALUATION OF GAMMA SCANNING AS A TOOL FOR DETERMINING FUEL-BURNUP DISTRIBUTIONS IN LARGE POWER REACTOR CORES. Richard J. Nodvik (Westinghouse Electric Co., Pittsburgh). Trans. Am. Nucl. Soc., 8: 103-4(May 1965).

29664 POWER-DISTRIBUTION MEASUREMENTS AT DRESDEN. D. L. West and W. R. Morgan (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 8: 104-5(May 1965).

29665 APPLICATION OF IN-CORE DETECTORS TO START-UP OF LARGE BOILING-WATER REACTORS. R. A. DuBridge (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 8: 105(May 1965).

29666 STABILITY MEASUREMENTS ON THE BORAX-V PERIPHERAL SUPERHEATER CORE. Darrell C. Cutforth (Argonne National Lab., Idaho Falls, Idaho) and Dale Mohr. Trans. Am. Nucl. Soc., 8: 106(May 1965).

29667 NUCLEAR AND THERMAL PERFORMANCE OF ESADA — VALLECITOS EXPERIMENTAL SUPERHEAT REACTOR. P. W. Ianni, T. Tillinghast, and R. T. Pennington (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 8: 107(May 1965).

29668 BONUS REACTOR OPERATING EXPERIENCE. J. M. West (Combustion Engineering, Windsor, Conn.), A. S. Jameson, W. T. Withers, W. W. Gerken, and J. H. Fragoso. Trans. Am. Nucl. Soc., 8: 107-8(May 1965).

29669 PATHFINDER CRITICALITY PREDICTIONS AND MEASUREMENTS. Patrick Lacy (Allis-Chalmers Mfg. Co., Bethesda, Md.), John Fisher, Richard Kern, and Charles E. Larson. Trans. Am. Nucl. Soc., 8: 108-9(May 1965).

29670 ADDING SUPERHEATING REGIONS TO IMPROVE BWR PERFORMANCE. D. H. Imfohh (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 8: 110(May 1965).

29671 SUPERCRITICAL-PRESSURE REACTOR TECHNOLOGY. J. H. Wright, W. H. Comtois, J. F. Patterson, and H. B. Kellogg (Westinghouse Electric Co., Pittsburgh). Trans. Am. Nucl. Soc., 8: 110-11(May 1965).

29672 EXPERIENCES IN THE DECOMMISSIONING AND DISMANTLING OF THREE ORNL EXPERIMENTAL

REACTORS. S. E. Beall (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 113(May 1965).

29673 REACTOR DEACTIVATION, EBR-I AND BORAX-V. J. D. Cerchione, F. D. McGinnis, R. E. Rice, and C. B. Doe (Argonne National Lab., Idaho Falls, Idaho). Trans. Am. Nucl. Soc., 8: 114-15(May 1965).

29674 REMOVAL OF THE PM-2A NUCLEAR POWER PLANT FROM CAMP CENTURY. Joseph P. Franklin (Army Nuclear Power Field Office, Ft. Belvoir, Va.). Trans. Am. Nucl. Soc., 8: 117-18(May 1965).

29675 SELECTION OF FUEL-CLADDING MATERIALS FOR NUCLEAR SUPERHEAT REACTORS. C. N. Spalaris (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 8: 121-2(May 1965).

29676 RESULTS OF IRRADIATION EXPERIMENTS ON COMBINATION BOILING/SUPERHEAT FUEL ELEMENTS IN THE KAHL NUCLEAR POWER STATION. R. Schwarzwaelder, J. Hoechel, and G. Harling (Allgmeine Elektricitats-Gesselschaft-KEA, Frankfurt am Main). Trans. Am. Nucl. Soc., 8: 123-5(May 1965).

29677 COUNTER CURRENT REFUELLING IN THE ORDERED-BED FAST REACTOR. W. E. Winsche, J. Chernick, L. G. Epel, L. Green, and M. M. Levine (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 8: 134-5(May 1965).

29678 TANDEM FUELING OF THERMAL REACTORS. K. H. Campbell (Canadian General Electric Co., Ltd., Peterborough, Ont.). Trans. Am. Nucl. Soc., 8: 135(May 1965).

29679 APPLICATION OF ADVANCED PM FINGER-TYPE CONTROL RODS FOR LARGE POWER REACTORS. Kenneth H. Dufrane (The Martin Co., Baltimore). Trans. Am. Nucl. Soc., 8: 135-6(May 1965).

29680 SYMBIOTIC SYSTEMS ANALYSIS OF RESOURCE REQUIREMENTS. S. Jaye and R. Taylor (General Atomic, San Diego, Calif.). Trans. Am. Nucl. Soc. 8: 136-7(May 1965).

29681 EVALUATION OF THE OFF-SITE CONSEQUENCES OF A HYPOTHETICAL ACCIDENT IN A NUCLEAR REACTOR. Roger C. Nichols (Westinghouse Electric Co., Pittsburgh). Trans. Am. Nucl. Soc. 8: 138 (May 1965).

29682 THE REACTION OF STEAM WITH LARGE SPECIMENS OF GRAPHITE FOR THE EXPERIMENTAL GAS-COOLED REACTOR. R. E. Helms and R. E. MacPherson (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 140-1(May 1965).

29683 ANALYSIS OF PRESTRESSED-CONCRETE REACTOR STRUCTURES BY THE FINITE-ELEMENT METHOD. Yusef R. Rashid and D. C. Cornell (General Atomic, San Diego, Calif.). Trans. Am. Nucl. Soc., 8: 146-7(May 1965).

29684 DESCRIPTION, APPLICATION, AND SITING OF THE STURGIS (MH-1A) FLOATING NUCLEAR POWER PLANT. Robert M. Bunker (Aktiebolaget Atomenergi, Stockholm). Trans. Am. Nucl. Soc., 8: 152(May 1965).

29685 ECONOMICS OF SMALL NUCLEAR ELECTRIC-DESALINATION PLANTS. Robert L. Baer and Donald E. Solberg (Hittman Associates, Inc., Baltimore). Trans. Am. Nucl. Soc., 8: 155-6(May 1965).

29686 COMPARISON OF HIGH-TEMPERATURE AND LOW-TEMPERATURE REACTORS FOR USE IN DUAL-PURPOSE SEA-WATER EVAPORATOR AND ELECTRIC-POWER STATIONS. R. Van Winkle, R. A. Ebel, and R. B. Winsbro (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 156-7(May 1965).

29687 USE OF LOW-TEMPERATURE FAST REACTORS FOR DESALINATION OR POWER. R. S. Carlsmith and R. E. Hoskins (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 157-8(May 1865).

29688 STABILITY OF RANDOMLY PACKED BEDS OF FUEL SPHERES. A BASIC PROBLEM IN THE DESIGN OF SETTLED-BED FAST REACTORS. R. J. Parsick, S. C. Jones, and L. P. Hatch (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 8: 158-9(May 1965).

29689 LIQUID-FUEL SYNTHESIS USING NUCLEAR POWER IN A MOBILE ENERGY DEPOT SYSTEM. M. Beller and M. Steinberg (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 8: 159(May 1965).

29690 CALCULATION OF POWER-DISTRIBUTION END OF DRESDEN SECOND FUEL CYCLE. N. D. Witt (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 8: 208-9(May 1965).

29691 REACTOR PHYSICS CONSIDERATIONS IN THE DESIGN OF A POWER REACTOR PARTIALLY LOADED WITH PuO_2–UO_2. H. A. Risti and A. J. Impink (Westinghouse Electric Co., Pittsburgh). Trans. Am. Nucl. Soc., 8: 209-10(May 1965).

29692 USE OF BERYLLIUM ZONES TO ENHANCE SAFETY OF FAST BREEDER REACTORS. D. K. Butler, H. H. Hummel, W. B. Loewenstein, and D. Meneghetti (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 239-40(May 1965).

29693 ZONED SPECTRUM CORE. J. B. Nims (Atomic Power Development Associates, Inc., Detroit), E. M. Page, and K. L. Mahna). Trans. Am. Nucl. Soc., 8: 240(May 1965).

29694 EXPERIMENTAL DETERMINATION OF POWER COEFFICIENTS BY TRANSIENT METHODS AT PIQUA NUCLEAR POWER FACILITY. Norman K. Rumpf (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 8: 256(May 1965).

29695 ZERO-POWER PHYSICS TESTING IN CAROLINAS–VIRGINIA TUBE REACTOR. W. Willoughby, II (Carolinas–Virginia Nuclear Power Associates, Parr, S. C.), and R. J. Nath. Trans. Am. Nucl. Soc., 8: 267-8 (May 1965).

29696 FAST-REACTOR SAFETY EXPERIMENTS ON EBR-II-TYPE THORIUM–URANIUM FUEL. C. E. Dickerman, L. E. Robinson, and R. Stewart (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 309(May 1965).

29697 SELECTED POWER REACTOR PROJECTS IN CANADA AND THE UNITED STATES OF AMERICA. (International Atomic Energy Agency, Vienna (Austria)). Technical Reports Series No. 36. 1964. 73p. STI/DOC/10/36. $2.00; S 42,–; 12/-stg; F.Fr. 8.–; DM 6.40(IAEA).

Progress is reported on the NPD, Elk River, Bonus, Pathfinder, Piqua, Hallam, Peach Bottom, and EGCR power and power-demonstration reactors. (T.F.H.)

29698 IMPROVEMENTS RELATING TO HEAT EXCHANGERS PARTICULARLY FOR NUCLEAR REACTORS. William George Hutchinson and Owen Hayden (to United Kingdom Atomic Energy Authority). British Patent 985,464. Mar. 10, 1965. Filed Oct. 17, 1962.

A shell and tube heat exchanger system includes a top closure plug for the tank with apertures penetrating through the plug. Below the closure plug is a header for receiving a primary coolant and provided with apertures in positions corresponding with the closure plug apertures. Units in the form of an elongated heat exchanger shell carried independently by each insert plug can be inserted through the header apertures. Each unit has an inlet opening adapted to fit in the header to permit flow of primary coolant through the heat exchanger unit. Means are provided to seal the units against passage through the header apertures of primary coolant. A secondary coolant conducting means is included in each unit with the inlet and outlet both at the header end of the unit. The units may be individually slid out for repair or replacement. Remotely operable adjustment of the sealing means between the units and the header apertures is provided. (B.L.M.)

29699 NUCLEAR REACTOR PLANTS WITH GAS-COOLED REACTORS. (to Sulzer Brothers Ltd.). British

Patent 985,646. Mar. 10, 1965. Priority date Mar. 6, 1963, Switzerland,

A nuclear reactor plant includes a gas cooled reactor, a reservoir to replenish the reactor cooling system, and means in the flow path of cooling gas from the reservoir to the cooling system for supplying from a supply of high-temperature liquid at least some of the heat required for evaporation of the gas. The reactor plant may also include a steam circuit containing a heat exchanger in which the working medium is heated by the coolant gas. Alternatively, for a liquid moderated reactor, the liquid moderator in a feed tank may constitute the high-temperature liquid supply. An automatic system arranged to be actuated in dependence on the pressure and flow of coolant in the reactor introduces coolant from the reservoir in the event of a situation endangering the reactor core. (B.L.M.)

29700 NUCLEAR REACTOR PLANTS. (to Sulzer Brothers Ltd.). British Patent 985,647. Mar. 10, 1965. Priority date Mar. 20, 1963, Switzerland.

In a gas-cooled reactor plant, a number of parallel connected heat exchangers are provided in the heat carrier circuit with shut-off elements being provided for the isolation of individual heat exchangers. Means are included for the detection at intervals of the presence of heat carrier in the working medium in each element exchanger, and an automatic arrangement operates the shut-off element to isolate a leaky part of the heat exchange surface when a predetermined level is reached. (B.L.M.)

29701 IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTOR PLANTS. (to Sulzer Brothers Ltd.). British Patent 985,728. Mar. 10, 1965. Priority date Sept. 12, 1962, Switzerland.

A method is provided for controlling the rate of feed of a working medium to a vapor generator of a nuclear plant in which the working medium is evaporated and superheated by means of a heat carrier. The heat carrier circulates through the reactor and vapor generator and flows countercurrent to the working medium through the vapor generator. The entry temperature of the heat carrier in the vapor generator is maintained substantially constant. Controlling the rate of feed of the working medium is directly dependent upon a temperature at an intermediate point in the superheater section of the vapor generator. The temperature of the carrier leaving the vapor generator also controls the rate of feed. Means are also provided for directing the working medium from an intermediate point in the superheater section along a shortened path to a temperature detector disposed outside the flow path of the heat carrier. (B.L.M.)

29702 SUPERHEATING NEUTRONIC REACTOR. Hermann Kumpf (to Siemens-Schuckertwerke AG). Canadian Patent 684,187. Apr. 14, 1964. Priority date Mar. 7, 1958, Germany.

A method is described for dividing the core of a pressurized water reactor into areas that are cooled by cooling media at different temperatures. Additional means are provided for segregating the cooling media and for conducting it out of the reactor vessel. The segregating means is further arranged in conjunction with a secondary cooling circuit for producing and superheating steam or other working fluid at a location that can be variably spaced from the reactor so that the steam does not become radioactive as a result of contact with the fuel elements within the vessel. Thus, a single reactor is employed for both generating and superheating steam or other working fluid without elimination of the secondary cooling circuit or employment of a dual reactor system. The reliability and ease of control of a pressurized water reactor is retained inasmuch as the high temperature or superheating region of the core does not include the most active portion of the core. (B.L.M.)

29703 ELECTRON EMISSION REACTOR. Rainer Gunther (to Battelle-Institut e. V.). Canadian Patent 684,327. Apr. 14, 1964. Priority date Mar. 19, 1960, Germany.

An electron emission reactor is described for the conversion of heat from a nuclear reactor to electrical energy. The reactor is composed of an emitter electrode heated by the fissionable material, and a cold collector electrode opposite to and electrically insulated from the emitter electrode. A base carrier receiving the fissionable material is in electric contact with the emitter. The carrier, made of a material of good electrical conductivity at high temperatures, serves as a conductor. The carrier is provided with shunts on its side remote from the emitter, the shunts being arranged in layers transversely to the flow direction of the current. The layers of higher operating temperature consist of specially heat-resistant material, and the layers of lower operating temperature consist of material of high electric conductivity and small heat conductivity. (B.L.M.)

29704 HETEROGENEOUS ATOMIC REACTOR. Bernt T. A. Hargoe and Dick G. Dahlgren (to Aktiebolaget Atomenergi). Canadian Patent 689,709. June 30, 1964. Priority date May 11, 1960, Sweden.

In a heterogeneous reactor designed to be self-regulating, the fuel is in the form of spaced, parallel, cylindrical rods of fissionable material evenly distributed over the entire cross section of the pressure vessel. The fuel rods are arranged in groups, and each rod is supported by a frame at both ends and at least one intermediate point. The rods extend in the direction of flow of the heavy water that serves as both moderator and coolant. The diameter of the rods is <20 mm, and the rods are so spaced from each other that the ratio of the volume of heavy water to the volume of fuel in the vessel is more than 5 to 1. The space between the rods is free of partitions; therefore, the heavy water is free to flow in all directions. The reactor is designed to operate at a water temperature higher than 100°C. (B.L.M.)

29705 LIQUID METAL COOLED NUCLEAR REACTORS. Georges Vendryes and Jacques Duport (to Commissariat à l'Énergie Atomique). Canadian Patent 691,114. July 21, 1964. Priority date Mar. 10, 1961, France.

A reactor cooled by the circulation of liquid metal is designed in which suitable distribution of the coolant through the different regions of the reactor is accomplished by a single supply conduit. A liquid-tight tank is also provided in which the point of coupling of the supply conduit with the bottom portion is designed to withstand efforts that are compatible with the good mechanical strength of the bottom portion of the tank. The strict centering of the reactor core on the axis of the tank is ensured irrespective of operating conditions. The reactor is designed to operate in a continuous manner at a power level chosen in a wide power range. (B.L.M.)

29706 COMBINED BOILING WATER SUPERHEATER REACTOR. Heinz Kornbichler and Erhard Fischer (to Licentia Patent-Verwaltungs-GmbH). Canadian Patent 692,479. Aug. 11, 1964. Priority date Feb. 26, 1959, Germany.

A nuclear power plant is made up of two or more reactors in which saturated steam is tapped from one or several of the reactors. The saturated steam from a reactor, e.g. the boiling water type, is superheated in the superheater reactor, which has a pressure vessel and a reactor core within. The core is formed of a plurality of tubular elements containing the fuel elements, each of which is made up of a bundle of fuel rods. The assembly of tubular elements forms an inner zone and a peripheral outer zone with moderating water filling the space between the tubular elements. The fuel elements are thermally insulated from the moderating water. The tubular elements can be fixed at their upper and lower ends to an upper and lower end plate, respectively. The saturated steam first passes through the outer zone to the cooling channels and is superheated, and then passes in opposite direction through the inner zone so as to attain its maximum temperature. In order to enable utilization of the heat energy produced in the moderator, a tank-like structure may be formed around the tubular elements by connecting the upper end

plate with the lower end plate by a cylindrical mantle. (B.L.M.)

29707 FUEL ELEMENT FOR A SUPERCRITICAL PRESSURE POWER REACTOR. Harold Harty, James J. Regimbal, Kadzuhsa F. Toyda, and Richard D. Widrig (to U. S. Atomic Energy Commission). U. S. Patent 3,188,278. June 8, 1965.

Description is given of a fuel element for a supercritical pressure power reactor including a fuel zone disposed within a jacket, inlet pressure tubes extending through the periphery of the fuel zone, outlet pressure tubes positioned interiorly of the inlet tubes, a graphite cup at one end of the fuel element, and a return chamber disposed in the graphite cup and connected to the inlet and outlet pressure tubes. (AEC)

Process Heat Reactors

29708 (HPR-39) COOLANT VOID REACTIVITY EFFECTS IN THE SECOND CHARGE OF HBWR. PART I. DIFFERENTIAL EXPERIMENTS AT LOW TEMPERATURE. F. W. A. Habermann, K. Jahren, J. E. Lunde, and O. Oeye. (Institutt for Atomenergi, Halden (Norway). OECD Halden Reaktor Prosjekt). Nov. 1964. 91p. Dep.(mn).

A series of void reactivity experiments has been performed in the zero power reactor NORA with HBWR second charge fuel elements. The coolant channel of one fuel element was subdivided in sections in which the water level could be depressed by air. The reactivity effect of voids created in this way was measured for various combinations of channels. The measured effect was always negative and largest in absolute magnitude in the center of the fuel cluster. The interaction between voided channels was such as to increase the absolute magnitude of the reactivity effects. Using a first order perturbation expression based on two-group theory for an anisotropic reactor, two experimental parameters were evaluated representing respectively multiplication and leakage properties of the voided lattice. These parameters are compared with lattice parameter calculations. Good agreement between experiment and theory is obtained for the multiplication parameter, and also for the leakage parameter when the channel is fully voided. Too low theoretical values for the leakage parameter for small void fractions result in a maximum of about 20% underestimate in reactivity, while for a fully voided coolant channel the agreement is within the experimental accuracy. (auth)

29709 (JPR-41) COOLANT VOID REACTIVITY EFFECTS IN THE SECOND CHARGE OF HBWR. PART III. INTEGRAL EXPERIMENTS. F. W. A. Habermann, K. Jahren, J. E. Lunde, A. Rumpold, and O. Oeye (Institutt for Atomenergi, Halden (Norway). OECD Halden Reaktor Prosjekt). Dec. 1964. 56p. Dep.(mn).

Experiments investigating the reactivity effects due to fuel temperature and steam voids in the coolant channels were conducted in the second fuel charge of HBWR. The measurements were made at power levels up to 20 Mw and at various temperatures and degrees of subcooling. Theoretical comparisons are given, based upon two-group diffusion theory and using proper power and void distributions in the core. When perturbation theory is used in order to obtain the power reactivity effect, good agreement between theory and experiment is found at 190°C, while at 230°C about 12% too large negative reactivity values are obtained. Two dimensional macroscopic calculations of power reactivity at 230°C give good agreement with measured values. (auth)

29710 (HPR-49) SINUSOIDAL REACTIVITY PERTURBATION EXPERIMENTS WITH THE HBWR SECOND FUEL CHARGE. V. Tosi and F. Akerhielm (Institutt for Atomenergi, Halden (Norway). OECD Halden Reaktor Prosjekt). Dec. 1964. 71p. Dep.(mn).

The response of HBWR II to sinusoidal perturbation in reactivity has been measured for different values of power parameters in the frequency range 0.002–1 c/s. The parameters considered were: nuclear power level, subcooling, vessel pressure, moderator level and number of steam transformers. The object of investigation was, mainly, the core dynamics. The variables recorded were those given by standard reactor plant instrumentation, e.g. nuclear power, steam pressure and flow, and by in-core instruments, e.g., outlet coolant velocity, moderator temperature and coolant inlet temperature. Experiments were performed also at conditions where the system exhibits self-sustained oscillations of limited amplitude. Trapping phenomenon between these oscillations and the external excitations has been observed and qualitatively reproduced on an analogue mock-up. (auth)

29711 (HPR-50) PSEUDO-RANDOM REACTIVITY PERTURBATION EXPERIMENTS WITH THE HBWR SECOND FUEL CHARGE. Y. Fishman (Institutt for Atomenergi, Halden (Norway). OECD Halden Reaktor Prosjekt). Dec. 1964. 47p. Dep.(mn).

Dynamic experiments, using binary pseudo random reactivity perturbations, have been performed on the HBWR, at powers ranging from 5 to 15 Mw. The technique is described, and assessed for noise and non-linearities of the kind that were encountered within the system that was studied. System stability depended on total power, subcooling ratio, vessel pressure, and D_2O level. When the stability limit was reached, the system oscillated at ~0.005 c/s. At ~15 Mw the system was divergently unstable. Reactivity to power and power to pressure "transfer functions" were measured. Other transfer functions, involving temperatures for example, were too strongly affected by the non-linearities of the system to be of significant value. A non-linear analog computer mock-up is described. It is based on the experiments, and helps in the interpretation of the results. (auth)

29712 (HPR-51) STEP PERTURBATION EXPERIMENTS WITH THE HBWR SECOND FUEL CHARGE. A. Brouwers (Institutt for Atomenergi, Halden (Norway). OECD Halden Reaktor Prosjekt). Dec. 1964. 78p. Dep.(mn).

The HBWR system with the second fuel charge is described. Experiments have been performed with this system in which step functions are introduced in reactivity, in the steam flow of the primary circuit, and also in the steam flow of the tertiary circuit. The responses of several system parameters are given; some of these step function responses have been converted to the frequency domain. The responses to positive and negative step function perturbations clearly show the existence of asymmetric non-linearities in the system; this phenomenon is further discussed. Some remarks are also given with regard to the unstable behavior of the reactor system. (auth)

29713 (HPR-56) FLUX DISTRIBUTIONS IN THE HBWR SECOND FUEL CHARGE. K. Bryhn-Ingebrigtsen and K. Jahren (Institutt for Atomenergi, Halden (Norway). OECD Halden Reaktor Prosjekt). Dec. 1964. 30p. Dep.(mn).

The influence of steam void on the macroscopic flux distribution was investigated in the second fuel charge of HBWR. Experimentally, it was found that the influence of steam voids on the thermal axial neutron flux distribution is small. The axial thermal neutron flux form factor in the central part of the core shows no significant change compared with nonboiling condition when the power is raised to 17.3 Mw, which corresponds to an average coolant void fraction of 0.4. Measurements show that the effect of fully voiding the coolant channel on the intracell flux distribution is also small. Thermal utilization factors inferred from the measurements are compared with theoretical values. Three different theoretical approaches were applied. The flux peaking effect due to spacers between fuel segments was measured. (auth)

29714 (HPR-58) XENON TRANSIENT EXPERIMENT WITH THE HBWR. J. Davidson and V. Tosi (Institutt for Atomenergi, Halden (Norway). OECD Halden Reaktor Prosjekt). Dec. 1964. 37p. Dep.(mn).

Xenon reactivity transient experiments were performed for both the first and second fuel charge of HBWR. The

measured reactivity values are in good agreement with theoretical values obtained by the use of two-group perturbation theory, taking into account the spatial distribution of xenon. For the second fuel charge an average flux could be used for xenon concentration calculation, due to the relatively flat power distribution. (auth)

Production Reactors

29715 (CEA-R-2710) DETECTION DE RUPTURE DE GAINES G3—EXPERIENCE D'EXPLOITATION. (Can Rupture Detection in G3—Operational Experience). Julien Plisson (Commissariat a l'Energie Atomique, Chusclan (France). Centre de Production de Plutonium de Marcoule). Dec. 1964. 24p. Dep.(mn).

After briefly reviewing the role and the principles of can rupture detection, the working conditions and the conclusions reached after 4 years operation of the installation on the reactor G3 are described. The modifications made to the original installation as well as the tests carried out and the experiments under way are mentioned. (auth)

29716 (CEA-R-2764) LA RADIOPROTECTION ET L'ARGON 41 FORME DANS LES PILES G1 ET G2/G3. (Radioprotection and the Argon 41 Formed in the Reactors G1 and G2/G3). Jean-Philippe Chassany, Robert Paillard, and Pierre Meffere (Commissariat a l'Energie Atomique, Chusclan (France). Centre de Production de Plutonium de Marcoule). Apr. 1965. 19p. Dep.(mn).

The activation of argon-40 present in the air (9.3 l/m^3) or in trace form in CO_2 is particularly important. In G1, the cooling is effected by atmospheric air which passes through the reactor and is expelled through a chimney. The activity due to argon-41 of the expelled air is about 10^{-4} C/m^3. For the reactors G2 and G3, the cooling is effected using CO_2 in a closed circuit at a pressure of 15 kg/cm^2. Although the argon content of industrial CO_2 is practically constant, it can be influenced by that of the residual air left in the circuits during the start-up. The activity due to argon-41 of the heat-carrying fluid is about 10^{-3} C/m^3. (auth)

29717 (HW-60747(Add.)) DESIGN CRITERIA FOR PROJECT CGI-839, REV. 3. MODIFICATION OF FUEL ELEMENT TEST FACILITIES 1706-KER—KER SAFETY CIRCUIT IMPROVEMENTS. C. O. Clemetson and E. M. Davis (General Electric Co., Richland, Wash. Hanford Atomic Products Operation). Jan. 30, 1962. Contract AT(45-1)-1350. 28p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

Design criteria are presented that are required during certain improvements in the Hanford KE Reactor safety circuits. The objective of the criteria is to define the method of meeting functional, process, and operational requirements for the modified KER safety circuit. The improvements consist in the installation of instrumentation and circuitry to change certain of the KER circuits to two-out-of-three tripping circuits. (T.F.H.)

29718 (RL-NRD-81) OPERATIONAL MODES ANTICIPATED FOR THE CONVERTED N-REACTOR PLANT. R. E. Hall and E. W. Wilson (General Electric Co., Richland, Wash. Hanford Atomic Products Operation). Jan. 20, 1965. Contract AT(45-1)-1350. 20p. Dep.(mn). $1.00(cy), 1(mn) CFSTI.

Operation of the converted N-Reactor Plant during the anticipated operational modes will be influenced primarily by the assurance of adequate steam for auxiliary system usage within the reactor plant and by the desire for maximum steam consumption within the generating plant. The functional procedures in force during a reactor shutdown, a reactor startup, normal equilibrium operation, and the scram conditions are presented with emphasis on the changes in operating modes necessitated by conversion to Phase II conditions. Coordination of the startup of the generating plant in conjunction with the reactor plant requires close communication between the two control centers to assure adequate heat dissipation capability and condensate availability to the secondary coolant system. Following a rapid transient such as reactor scram and turbine trip off, emergency actions within the generating and reactor plant are primarily oriented towards re-establishment of operational techniques consistent with Phase I modes of operation, e.g., restoration of a source of condensate makeup from the 184 deaerator and shutdown of the 185-N facilities. All transients appear to be within operational capabilities, and adequate flexibility has been provided for emergency conditions. (auth)

29719 (RL-REA-183) UNIVERSAL VERTICAL SAFETY ROD REACTIVITY EVALUATION. W. A. Blyckert (General Electric Co., Richland, Wash. Hanford Atomic Products Operation). Nov. 18, 1964. Contract AT(45-1)-1350. 16p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

A testing program was conducted to evaluate the poison strength of the universal vertical safety rods. The rod subassemblies were seven per cent more poisonous than a B-size rod section. The results of the evaluation program indicate that the rods are satisfactory for use in the Hanford production reactors. (auth)

29720 A DESCRIPTION OF THE SAVANNAH RIVER HIGH-FLUX CHARGE. J. L. Crandall, J. A. Smith, and O. A. Towler (E. I. du Pont de Nemours and Co., Aiken, S. C.). Trans. Am. Nucl. Soc., 8: 53-4(May 1965).

29721 ISOTOPE PRODUCTION IN A SAVANNAH RIVER REACTOR AT FLUX LEVELS ABOVE 10^{15} $n/(cm^2$ sec). J. A. Smith, E. J. Hennelly, C. H. Ice, and H. F. Allen (E. I. du Pont de Nemours and Co., Aiken, S. C.). Trans. Am. Nucl. Soc., 8: 54(May 1965).

29722 PHYSICS DESIGN OF THE SAVANNAH RIVER HIGH-FLUX CHARGE. W. E. Graves, G. F. O'Neill, A. E. Dunklee, and S. V. Topp (E. I. du Pont de Nemours and Co., Aiken, S. C.). Trans. Am. Nucl. Soc., 8: 54-5(May 1965).

29723 SAVANNAH RIVER HIGH-FLUX CHARGE—ENGINEERING. E. C. Nelson, D. Baker, Jr., S. Mirshak, and A. H. Peters (E. I. du Pont de Nemours and Co., Aiken, S. C.). Trans. Am. Nucl. 8: 55-6(May 1965).

29724 TEMPERATURE COEFFICIENTS OF REACTIVITY IN THE SAVANNAH RIVER HIGH-FLUX CHARGE. C. E. Bailey, N. P. Baumann, and C. E. Jewell (E. I. du Pont de Nemours and Co., Aiken, S. C.). Trans. Am. Nucl. Soc., 8: 56(May 1965).

29725 OPERATING EXPERIENCE WITH THE FIRST SAVANNAH RIVER HIGH-FLUX CHARGE. O. A. Towler, J. R. Hilley, L. W. Fox, and R. F. Anderson (E. I. du Pont de Nemours and Co., Aiken, S. C.). Trans. Am. Nucl. Soc., 8: 56-7(May 1965).

29726 OPERATIONAL PROCEDURES IN DEACTIVATION OF THE HANFORD PRODUCTION REACTORS. Sterling L. Nelson (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 8: 116-17(May 1965).

29727 DESIGN CONSIDERATIONS IN THE SELECTION OF MATERIALS FOR THE HFIR. J. R. McWherter, J. R. McGuffey, and J. H. Westsik (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 145(May 1965).

29728 NUCLEAR AND THERMODYNAMIC CONSIDERATIONS IN THE DESIGN OF THE HFIR BERYLLIUM REFLECTOR. J. R. McWherter and Neil Hilvety (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 145-6 (May 1965).

29729 APPLICATIONS OF NPR TECHNOLOGY TO THE NATIONAL NUCLEAR PROGRAM. H. R. Kosmata (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 8: 154-5(May 1965).

Propulsion and Space

See also ENGINEERING — Space Propulsion.

Refer also to abstracts 28491, 28495, and 28714.

29730 (64SD-913) STUDY ON APPLICATION OF NUCLEAR ELECTRICAL POWER TO MANNED ORBITING

SPACE STATIONS. Final Summary Report. (General Electric Co., Philadelphia, Pa. Missile and Space Div.). Sept. 7, 1964. Contract NAS-3-4160. 78p. (NASA-CR-54161; N64-29574) $7.60(CFSTI).

The applicability of power reactors for electricity generation in manned orbiting space stations is studied. The purposes of the study include system evaluation, development of parametric design data, preliminary design of a power plant based on the SNAP 8, and preparation of developmental specifications. The reactor system studied is found to be feasible and safe to the general public. (T. F.H.)

29731 (APS-5152-R1(Suppl.1)) SNAP-50/SPUR QUARTERLY TECHNICAL PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1964. (Garrett Corp., Phoenix, Ariz. AiResearch Mfg. Div.). Apr. 15, 1965. Contract AF33(615)-2289 and AF33(615)-1551. 61p.

An extension of Report APS-5084-R is presented which includes a more detailed study of the converter design and a more complete investigation of the heat-rejection system for the converter. The reliability of the converter was predicted from data on component reliability. The converter selected for this application is a hybrid type producing square-wave, three-phase power. Square-wave output allows a simplification in the switching and control circuitry of the converter. Induction motors operate well on square-wave power because they effectively round off the square-wave current to a more sinusoidal wave shape. With three-phase power, the pump motors can be oversized to start and carry full power with one phase open. This feature should be an aid in improving motor reliability. (J.R.D.)

29732 (APS-5152-R2) QUARTERLY TECHNICAL PROGRESS REPORT [ON] SNAP-50/SPUR, FOR PERIOD ENDING MARCH 31, 1965. (Garrett Corp., Phoenix, Ariz. AiResearch Mfg. Div.). Apr. 17, 1965. Contracts AF33(615)-2289 and AF33(615)-1551. 200p.

Mechanical testing results on TZM, K-94, and K-601 alloys are reported along with those for arc-cast W and Mo-Ti-C systems. Development and testing bearings and seals for use with liquid-K are reported. Results of turbomachinery tests and analyses are included along with development and testing of potassium boilers. Work on condenser design and development, control system analysis, and auxiliary power supply analysis is summarized. (J.R.D.)

29733 (CONF-640810-1) THE 630A HIGH-PERFORMANCE MERCHANT SHIP NUCLEAR STEAM GENERATOR. R. E. Wood (General Electric Co., Cincinnati, Ohio. Nuclear Materials and Propulsion Operation). 1964. Contract [AT(40-1)-2847]. 43p. (TM-64-8-14). Dep.(mn); $2.00(cy), 1(mn) CFSTI.

From Conference on Nuclear Marine Propulsion, Blacksburg, Va.

The principal requirements for the 630 A merchant ship nuclear steam generator are reviewed. A description is given of the reactor, fuel assembly, propulsion system, and the control system. The operation and performance, safety investigations, installation and service, and economics studies are discussed. Diagrams are included. (L.B.S.)

29734 (CONF-650416-1) THE SNAP-50/SPUR NUCLEAR-ELECTRIC SPACE POWERPLANT PROGRAM. Elwood M. Douthett and Robert I. Strough (Pratt and Whitney Aircraft, Middletown, Conn. Connecticut Aircraft Nuclear Engine Lab.). Apr. 28, 1965. Contract AT(30-1)-2789. 18p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From 4th Symposium on Advanced Propulsion Concepts, Palo Alto, Calif.

The SNAP-50/SPUR project was established in 1962 and has for its ultimate objective the development of the technology for a 300 to 1000 kwe Rankine cycle nuclear space powerplant. The current phase of the program will culminate in the ground test of a reactor in 1970 and the test of a Rankine cycle conversion system in 1972. The SNAP-50/SPUR powerplant is a high-temperature, Rankine potassium vapor cycle plant deriving its energy from a very compact lithium-cooled reactor. Current program emphasis is centered on design and development of the reactor and component technology. The refractory metal technology required is already highly developed. Work is progressing well with many successful long-time fuel, material, and experimental component tests completed. The specific weight goal of 20 lbs/kw, unshielded, for the complete system appears attainable. While no specific requirement in this power range has yet been defined, the potential applications are many and varied, ranging from planetary probes to the manned Mars mission in the propulsion area and including military satellites, manned orbiting laboratories, and the lunar base in the auxiliary power area. Operational hardware could be delivered as early as the mid-1970s, if a requirement is defined within the next year or two and the program is adequately accelerated. (auth)

29735 (EGG-1183-1003) SNAP-TRAN EXPOSURE VALUES BASED ON TRIGA REACTOR PHOTOGRAPHY RESULTS. Robert A. Meibaum (Edgerton, Germeshausen and Grier, Inc., [Las Vegas, Nev.]). Nov. 20, 1963. Contract [AT(29-1)-1183]. 23p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

A description is given of the equipment, procedures, and results obtained from the photography of the Triga reactor to evaluate the intensity of the Cherenkov radiation immediately surrounding the core case when the reactor was operated in a pulsed condition. By comparing the intensity levels of known sources and the light from the Cherenkov radiation, an estimate was made of their relative intensities, which was used to determine the proper exposure for the SNAP reactor photographic coverage. (L.B.S.)

29736 (EUR-2180.e) NERO DEVELOPMENT PROGRAMME. Report Covering the Period January 1963 to June 1964. (Reactor Centrum Nederland, The Hague (Netherlands)). 1965. 64p. Dep.(mn).

The results obtained in the NERO Development Program, a program aimed at the development of a marine reactor, are described. After a discussion of the general features of the design, that is of both the interim design, called NEREUS, and of the NERO target design, the areas of core development, system and component development and of design work and calculations are reviewed. In the field of core development the critical experiments are reported, including studies of the effect of burnable poison on core parameters. The incorporation of burnable poison in the fuel is also discussed. Irradiation experiments and corrosion performance tests are other items of the core development program. In the system and component development programs the main emphasis has been on the steam generator performance test installation, on the preparation of pressurizer performance tests and on water quality control. In the design area studies were made of power distribution, burn-up, heat transfer and hydraulics. Heat transfer and hydraulic calculations are being backed up by experiments. A complete study of dynamics and control has been made which now allows a detailed safety analysis of the reactor system. Shielding work is being done both theoretically and experimentally. The design of the primary system and many of the auxiliary systems is also reported. (auth)

29737 (GEMP-190A) INTRODUCTION TO NUCLEAR PROPULSION. LECTURE 1. INTRODUCTION AND BACKGROUND. Gunnar Thornton (General Electric Co., Cincinnati, Ohio. Nuclear Materials and Propulsion Operation). Feb. 1963. Contracts [AT(11-1)-171] and NAS8-5215. 80p. Dep.(mn); $3.00(cy), 1(mn) CFSTI.

Consideration of the performance, weight, operational and other factors will favor the choice of nuclear propulsion systems for some applications and chemical systems for others. In some cases combinations of chemical and nuclear propulsion will be desirable. The application of a nuclear reactor to rocket propulsion is limited by the supply of rocket propellant that must be carried, even though the consumption of nuclear fuel is negligible. Nevertheless, since the propellant can consist entirely of a substance of low molecular weight, such as hydrogen,

a heat transfer nuclear rocket has a potential advantage of a factor of approximately 2 in specific impulse. In other words, a given thrust level can be sustained twice as long by a nuclear rocket as compared with a chemical rocket for the same weight of propellant. Alternately, the given thrust level may be sustained for the same period of time but with a much lower mass of stored propellant and consequently lower overall weight. Since this weight must be accelerated, a much higher velocity can be attained with the nuclear system when the thrust is applied over a fixed period. This provides a decided performance advantage for the nuclear system for a number of potential space missions. In air-breathing nuclear systems, such as turbojets and ramjets, a given thrust level can be sustained virtually indefinitely because the supply of propellant (air) is unlimited. However, since most air-breathing missions do not require acceleration to extremely high velocities, the fuel consumption during acceleration is usually not prohibitively large. Furthermore, most air-breathing missions operate within reach of additional fuel supplies. Consequently, the advantage of nuclear power for rockets appears to be a more critical one that is the case for air-breathing systems. (auth)

29738 (HW-82589) ANALOG SIMULATION OF THE HANFORD N-REACTOR PLANT. PART 1. DESCRIPTION OF THE OVERALL SIMULATION MODEL. C. D. Swanson, K. D. Coughren, P. J. Dionne, and G. G. Thieme (Hanford Atomic Products Operation, Richland, Wash.). Sept. 1, 1964. Contract AT(45-1)-1350. 200p. Dep.; $5.00(cy), 4(mn) CFSTI.

The design and testing of an analog simulation model for the NPR is described. The model is comprised of several subsystems that can be combined in various ways to provide the desired configuration for a given study. A basic overall simulation consisting of the reactor, a one-pump model primary loop, and a one-steam generator model, one-dump condenser model secondary loop forms the core of simulation models to be used for overall system studies. (T.F.H.)

29739 (IDO-17058) STEP PROJECT. Quarterly Technical Report, October–December 1963. E. R. Oetken, ed. (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.). Mar. 1965. Contract AT(10-1)-205. 122p. Dep.; $4.00(cy), 2(mn) CFSTI.

The technical progress made during the fourth quarter of 1963 in the STEP (Safety Test Engineering Program) Project by the Engineering and Test Branch is reported. The STEP Project includes transient testing of the SNAP 2/10A reactor system as part of the Atomic Energy Commission's aerospace safety program (SNAPTRAN tests), and a program for conducting a loss of fluid test (LOFT) on a pressurized water reactor system. Progress was made in developing data handling techniques for the SNAPTRAN tests, preparing three SNAP 2/10A reactors for tests, which consist of the SNAPTRAN 2/10A-1 test series directed toward studying the effects of reactivity insertions up to levels that cause partial core damage, the SNAPTRAN 2/10A-2 test series directed toward studying the effects of reactivity insertions that result in reactor destruction, and the SNAPTRAN 2/10A-3 test series directed toward studying the effect of reactivity insertions caused by sudden immersion in a water environment, designing a 50 Mw(t) reactor system for LOFT, and evaluating the suitability of using the PM-2A reactor in a precursor test to LOFT. (auth)

29740 (LA-3242) POSSIBLE REMOTE MAINTENANCE AND REPAIRS ON REACTORS AT NRDS. W. Charles Wofford (Los Alamos Scientific Lab., Univ. of California, N. Mex.). Nov. 1964. Contract W-7405-eng-36. 8p. Dep.; $1.00(cy), 1(mn) CFSTI.

Component malfunctions and failures on Kiwi series reactors at NRDS cannot presently be repaired or replaced remotely after reactor start up at the test cells. A discussion is presented of possible methods to correct such malfunctions on some components which might alter or abort a reactor test. The use of shielded vehicles for repairs or observations is discussed briefly, and past incidents of component failure and hydrogen leaks are mentioned. Redesign of certain existing reactor/test car components would be required, and the state of the art in remote handling would have to be expanded. A stockpile of spare reactor/test car components would be required for a reactor maintenance program. (auth)

29741 (LA-3257) OPTIMAL CONTROL OF NUCLEAR REACTOR PROCESSES. Ronald R. Mohler (Los Alamos Scientific Lab., Univ. of California, N. Mex.). Mar. 1965. Contract W-7405-eng-36. 153p. Dep.; $5.00(cy), 3(mn) CFSTI.

The problem of controlling nuclear reactor processes in some optimal manner is investigated. The theory is discussed, and models are formulated of a nuclear-reactor fission process, a direct-cycle heat exchanger, and a simplified nuclear rocket engine. These systems are found to belong to a general class called bilinear systems. An analysis is made of the optimal control of the classical mono-energetic neutron kinetics, considering various constraints on reactivity and state-variables. The theoretic terminal control is found to be unstable due to its open-loop nature. A closed-loop dither process is then introduced as a terminal control and performs very satisfactorily. For most purposes, it is shown that a conventional type of continuous closed-loop may be used. Optimal control of heat-exchange processes and the nuclear rocket engine are discussed. Coolant density reactivity and conventional temperature reactivity are investigated. In addition to the above neutronic constraints, consideration is given to constraints in reactor power and to constraints in the pumping of coolant. Conclusions are presented, and an outline of areas which seem fruitful for future research is given. (L.B.S.)

29742 (NAA-SR-10735) SNAP-10A FLIGHT SYSTEM PROTOTYPE (FSM-1) PERFORMANCE. L. L. Bixson, ed. (Atomics International, Canoga Park, Calif.). May 15, 1965. Contract AT(11-1)-Gen-8. 85p. Dep.; $3.00(cy), 2(mn) CFSTI.

A summary and evaluation of the thermal tests performed on the SNAP-10A, FSM-1 thermoelectric power conversion system is presented. The unit was a developmental, nonnuclear, full-scale version of the nuclear-powered flight system. The overall results of the tests verified the validity of the flight system design. Reactor heat was developed by an electrical core heater. Liquid metal coolant pumped through the reactor core by a thermoelectrically-driven, electromagnetic pump was maintained at an average temperature of over 920°F for more than 90 days. During this period, a total of 831 kwh of energy was generated by the thermoelectric converter at an average power level of 400 watts. The test was performed in a vacuum environment to simulate the heat transfer characteristics encountered in space. Additional tests simulated conditions and the sequence of events from ground launch to nuclear startup in earth orbit. (auth)

29743 (NAA-SR-Memo-10694) FLOW DIVIDED FOR MRP T/E PUMP COOLANT. K. A. Thomasson (Atomics International, Canoga Park, Calif.). Oct. 20, 1964. Contract [AT(11-1)-Gen-8]. 23p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

A block with four identical channels, simulating the coolant tubes in the thermoelectric pump with proper spacing, was constructed from clear Lucite to permit visual observation of the flow. Demineralized water was circulated through the block at a Reynolds Number equivalent to that of liquid Mercury in the actual SNAP 2 application. Black plastic beads with a specific gravity of 1.0 and globules of Unity Oil were introduced into the flow stream to allow visual observation of flow patterns and velocities. The data were recorded with a Milliken camera running at a film speed of 250 frames/second. The film was analyzed on a Vanguard Motion Analyzer and the channel flow velocities determined. Three different manifold designs were fabricated and tested. Manifold design #3 achieved the closest to equal distribution with a probable maximum deviation of ±50% in any channel from the average of the four channels. Three of the four channels indi-

cated velocities within 15% total deviation, but account was not taken of the local velocity profiles as the bead bounced from wall to wall in the channel. These data are qualitative and further experimentation would be necessary to determine the exact flow distribution in each individual channel. (auth)

29744 (NASA-CR-214) ANALYTICAL STUDY OF MODERATOR WALL COOLING OF GASEOUS NUCLEAR ROCKET ENGINES. G. H. McLafferty (United Aircraft Corp., East Hartford, Conn.). Apr. 1965. Contract NASw-847. 78p. $3.00(CFSTI).

An analytical study was conducted to investigate cooling problems in high-trust cavity-type gaseous nuclear rocket engines resulting from heat deposition within the interior of the moderator-reflector surrounding the cavity by neutrons and gamma rays and heat deposition on the surface of the cavity by fission fragments, beta particles, radiant heat transfer, and convection. The study included determination of the size and spacing of coolant tube passages required in the wall of the moderator-reflector and the pressure drop of the coolant fluid in these passages. A number of different coolant flow cycles were considered. The results of the study indicate that more heat will be deposited in the interior of the moderator than on the surface of the cavity, but that the heat deposited on the surface of the cavity may be more difficult to remove. Removal of the energy deposited in the interior of the moderator will require the use of a large number of small-diameter coolant passages. The major causes of cavity surface heating will be beta-particle impingement and thermal radiation, but calculations indicate that heating by beta-particle impingement can be reduced by the use of a magnetic field and that heating by thermal radiation can be reduced by the use of seeds in the propellant. In addition to a description of the moderator cooling study in the main body of the report, three additional studies are described in the appendices: determination of the fuel-containment characteristics of a gaseous nuclear rocket in which no attempt is made to separate propellant and fuel; determination of the effect of different propellants on the specific impulse of gaseous nuclear rockets; and a description of a facility concept which might be employed for testing gaseous nuclear rockets. (auth)

29745 (NASA-CR-54234(Vol.I)) SNAP-8 SEALS-TO-SPACE DEVELOPMENT TEST PROGRAM. VOLUME I. VISCO PUMP. Report No. 2808. R. L. Lessley (Aerojet-General Corp., Azusa, Calif.). May 1964. Contract NAS 5-417. 118p. (N65-17270). $4.00(CFSTI).

In order to permit use of oil-lubricated anti-friction bearings in the SNAP-8 power conversion system rotating assemblies, a seal is required to prevent mixing of mercury and oil. A seal concept was evolved in which mixing of mercury and oil is prevented by venting a section of the shaft to space and permitting a small controlled leakage of each liquid to the space vent cavity. The particular seal-to-space concept advocated for use in SNAP-8 involves use of the visco pump (a device consisting of a shaft with helical grooves rotating within a close-fitting housing). This seal element, when functioning properly, prevents passage of raw liquid through the seal. It establishes a liquid-vapor interface past which only vapors can leak. Visco pumps function improperly under certain conditions. A condition known as breakdown can prevail, in which case liquid droplets can be lost from the interface and the effectiveness of the seal as a barrier to liquid leakage is destroyed. Since the visco pump technology is not sufficiently advanced to permit prediction of conditions under which breakdown will occur, a test program was required to demonstrate the adequacy of the visco pump operating with SNAP-8 fluids (mercury and ET-378 oil) and operating conditions. Tests were conducted with quartz visco pump test sections which permitted viewing and photographing of the liquid-vapor interface during operation of the test rig. Results showed the visco pump interface to be stable for SNAP-8 operating conditions. There were no signs whatsoever of breakdown. In addition, measurements of drag and pumping coefficients were made for a variety of pump configurations. The visco pump has been shown to be very well suited for use in the SNAP-8 seals-to-space. A few subsidiary tests, which were run with configurations and operating conditions not representative of the SNAP-8 seal, revealed incipient and advanced stages of visco pump breakdown. Photographs and observations made during these tests have done much to clarify the nature of the breakdown phenomenon. (auth)

29746 (NASA-CR-54234(Vol.II)) SNAP-8 SEALS-TO-SPACE DEVELOPMENT TEST PROGRAM. VOLUME II. MOLECULAR PUMP. Report No. 2808. J. N. Hodgson (Aerojet-General Corp., Azusa, Calif.). May 1964. Contract NAS 5-417. 111p. (N65-17271). $4.00(CFSTI).

The seals-to-space of SNAP-8 require a means of restricting the flow of mercury and lubricant vapor out of the vent to space. This flow restriction is accomplished by use of a molecular pump—a highly effective form of flow restrictor based on the principle of the Holweck vacuum pump. Rather than using the static action of the conventional annulus or labyrinth, the molecular pump employs a dynamic action which moves molecules counter to the pressure gradient to space. The theoretical performance of the molecular pump was derived in detail as part of the flow restrictor development program. The theory was developed based upon the assumption of purely molecular flow. A computer program was conducted which allowed optimization of the molecular pump dimensions over a large variety of operating conditions. The independent variables exercised were diameter, speed, temperature, length, clearance, and molecular weight. A very basic problem exists, however, in that SNAP-8 operating conditions do not place the flow at the high-pressure end of the molecular pump in the molecular flow regime. On the contrary, the flow extends well into the continuum regime; thus the optimum configurations predicted by the optimization of the molecular theory are not truly optimum. To rectify this, a theory was developed which defines the performance of the molecular pump over the entire spectrum of flow regimes. This specially developed theory predicts the molecular pump performance for any given operating condition, and accounts for the changing flow regime within the pump itself. Unfortunately, the complexity of the final form of the performance equations has precluded an optimization program. However, sufficient insight into the flow phenomena has been gained by the theory to allow intelligent extrapolation from the molecular theory optimums toward the appropriate optimums for SNAP-8 operating conditions. Several configurations were chosen for the test program. The first few configurations were optimum as predicted by the molecular flow theory. As the testing proceeded, the undesirable effects of the non-molecular flow conditions became apparent. Remedial measures were taken by increasing the number of threads/in. and tapering the groove depth to make it shallow at the high-pressure end of the molecular pump. Both procedures increased the ratio of mean-free-path to channel dimensions, which served to make the flow more closely approach the molecular regime. The actual dimensions for these latter non-optimum configurations were based upon intuition and extrapolation from the molecular theory. Tests were conducted on both the optimum and non-optimum sets of configurations at temperatures of 300 and 375°F. The correlation between the theory and test data was good. Three basic problems were encountered during the test program: shaft seizure occurred several times during the initial phase of testing, equipment malfunction caused interface temperatures to be well in excess of 400°F, and entrained air in the bearing lubricant leaked into the molecular pump area causing pressure ratios to be low enough to lead to the premature conclusion that the molecular pump was not functioning. Once these problems were brought under control, a successful test program was carried out. Both pressure ratio and leakage data are in good agreement with theoretical predictions. The test program served to answer a number of questions regarding the effectiveness of the molecular pump as a flow restrictor. For example, it had not been known if the theory would adequately extend to the

geometrical limitations of the SNAP-8 application. (SNAP-8 requires a short molecular pump and large radial clearance, whereas in the original context as a vacuum pump the molecular pump is long and depends heavily on the radial clearance being small.) The test program indicated that the theory extends well to the SNAP-8 requirements. It was not known what influence continuum flow effects might have on the performance of the molecular pump. As a result of the transition flow theory which has been developed, it is now possible to predict the influence of non-molecular flow conditions. Tests have been made substantiating the validity of the theory. It was not known what configuration should be recommended for SNAP-8. Before a specific configuration was selected, consideration was given to the optimum values developed from the molecular flow theory, transition flow theory, and comparison of theoretical predictions with test results. The configuration selected has five threads/in., equal land and groove widths of 0.100 in., and a groove depth of 0.070 in. (auth)

29747 (NASA-CR-54234(Vol.III)) SNAP-8 SEALS-TO-SPACE DEVELOPMENT TEST PROGRAM. VOLUME III. DYNAMIC SLINGER. Report No. 2808. R. L. Lessley and I. L. Marburger (Aerojet-General Corp., Azusa, Calif.). May 1964. Contract NAS 5-417. 77p. (N65-17272). $3.00(CFSTI).

The seal-to-space concept advocated for use in the SNAP-8 power conversion system rotating assemblies utilizes two basic elements. The first element creates a liquid-vapor interface (i.e., a line of demarcation between liquid and vapor). The second element restricts leakage of the vapors which emanate from the liquid-vapor interface. A dynamic slinger has been selected as the liquid-vapor interface element for the current SNAP-8 seal-to-space configuration. In order for the slinger to fulfill its intended role, however, the liquid-vapor interface must be stable. Otherwise droplets may be generated by the interface which can possibly pass on through the seal. A series of tests was conducted in which oil and mercury slingers were operated at the specific conditions encountered in the SNAP-8 rotating assemblies. The purpose of these tests was to demonstrate that the slinger interfaces actually do provide a positive demarcation between liquid and vapor and thus create a barrier to prevent leakage of raw liquid. The slinger housings contained transparent sections which permitted observation of the interface during operation. Pumping and drag data were also collected. The oil slinger tests revealed the presence on the slinger static wall of a film that could serve as a vehicle for the transport of oil past the interface. It was found that this problem could be avoided by coating the slinger walls with a non-wettable material such as Teflon. Tests of mercury slingers revealed a small population of liquid droplets within the interface radius. The modification to the slinger configuration successfully eliminated this droplet formation. Thus, satisfactory slinger performance at SNAP-8 operating conditions is possible for both oil and for mercury. (auth)

29748 (NASA-CR-54234(Vol.IV)) SNAP-8 SEALS-TO-SPACE DEVELOPMENT TEST PROGRAM. VOLUME IV. INTEGRATED SEAL SIMULATOR. Report No. 2808. R. L. Lessley, J. N. Hodgson, and E. A. Haglund (Aerojet-General Corp., Azusa, Calif.). May 1964. Contract NAS 5-417. 49p. (N65-17273). $2.00(CFSTI).

A seal-to-space was developed to permit use of oil-lubricated bearings in the SNAP-8 mercury-vapor turbine assembly. Small leakages of oil and mercury to a space vent cavity are permitted (1 to 10 lb per year) in order to avoid intermixing of the two fluids. Since improper functioning of the seal would result in a complete loss of mercury and lubricating oil inventory, the development of the seal-to-space has been conducted in a very deliberate manner. The program included individual tests of each seal element and culminated with the test of a complete seal operating in the thermal environment of the SNAP-8 turbine seal. The results of this test are described. The basic seal concept utilizes a dynamic slinger to establish a liquid-vapor interface as a barrier to the flow of liquid. A molecular pump is used to restrict leakage of vapors emanating from the liquid-vapor interface. Since the leakage rate is very sensitive to the temperature of the liquid-vapor interface, provisions for cooling of the interface are included in the seal design. Two methods of cooling the interface were evaluated in separate test rigs: the Model A and Model B Seal Simulators. These test rigs duplicated very closely the configuration of a SNAP-8 turbine seal. They included a dummy turbine wheel and turbine housing into which 700°F mercury vapor was introduced. This provided faithful simulation of the actual thermal environment of a SNAP-8 turbine seal-to-space. The seal-simulator drive-spindle-bearing configuration was designed so as to resemble that of the SNAP-8 turbine. This permitted faithful simulation of the turbine lubricating oil seal-to-space. The test results revealed satisfactory results for both seal configurations. The Model A Seal Simulator leakage rates at SNAP-8 operating conditions were 3 lb of oil and 15 lb of mercury for each 10,000 hours of operation. The Model B Seal Simulator leakage rates were 12 lb of oil and 1 lb of mercury for each 10,000 hours of operation. Thus the effectiveness of the complete seal operating under conditions simulating those of the SNAP-8 turbine was demonstrated. (auth)

29749 (NASA-CR-54310) SNAP-8 ELECTRICAL GENERATING SYSTEM DEVELOPMENT PROGRAM. Quarterly Report No. 0390-04-18. (Aerojet-General Corp., Azusa, Calif.). Jan. 1965. Contract NAS-5-417. 324p.

The effects of system variables on the latest reference system parameters are analyzed. First testing of the turbine-alternator assembly using superheated mercury vapor as the working fluid is reported, and preliminary evaluations are discussed. The SNAP-8 tube-in-shell boiler was tested in conjunction with the TAA. Results were good and are discussed in detail. A 10,000 hour life test of an inorganic-insulated motor was successfully completed. (auth)

29750 (NP-14985) CONCEPTUAL DESIGN ANALYSIS OF A 5 MWE THERMIONIC REACTOR SPACE PROPULSION PLANT. F. A. Ross and T. F. Plunkett (Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.). Feb. 1965. 157p. (SM-46276). Dep.(mn).

The conceptual design of a 5 Mw(E) thermionic reactor propulsion plant is presented. Thermionic emission characteristics are evaluated for a cylindrical power converter incorporating a 60 v/o uranium dioxide-tungsten cermet fuel, a tungsten emitter and alternative collector materials. Optimization of the reactor and the associated primary coolant and heat rejection systems results in an average emission temperature of 2195 to 2285°K, and an average radiator coolant temperature of 1595°F under rated operating conditions. The specific weight of the overall propulsion plant incorporating electron bombardment ion engines is 19.4 lb/Kw(E) including radiator structure and a reactor shielding weight of 2.8 lb/Kw(E). The plant design features a high degree of reliability through the provision of redundancy, which accounts for approximately 10% of the plant weight. The heaviest single component in the plant is the power conditioning equipment. Application of an electromagnetic thrustor provides a potential decrease of about 4.6 lb/Kw(E) in plant weight through the reduction in power conditioning requirements. Relocation of the engine to be close to the reactor would further reduce the weight by another 1 lb/Kw(E). Further substantial weight reductions appear to be attainable as developments in high temperature materials technology and specialized fabrication techniques facilitate converter operation at higher temperatures, increased fuel loading, further optimization of meteoroid protection techniques and thinner wall material manufacturing and handling capability. The propulsion plant is integrated with the payload requirements for a manned Mars mission in a space vehicle configuration which is nominally within the Earth orbit capabilities of an augmented Saturn C-5 launch vehicle, assuming the propellant and crew are orbited by separate vehicles. A mission analysis is conducted to determine

the comparative performance of the plant as a function of thrustor limitations, specific weight and power level. The effects of using a separate nuclear rocket stage for Earth escape are also evaluated. Under stipulated conditions, the mission can be accomplished in about 20.5 months with a payload fraction of 0.14 and an initial weight of 970,000 lbs. in Earth orbit. (auth)

29751 (NRL-6251) THE PRESENT STATUS OF CHEMICAL RESEARCH IN ATMOSPHERE PURIFICATION AND CONTROL ON NUCLEAR-POWERED SUBMARINES. L. B. Lockhart, Jr., and V. R. Piatt, eds. (Naval Research Lab., Washington, D. C.). Mar. 23, 1965. 70p. $2.00(CFSTI).

Considerable progress has been made in the major efforts of developing: (a) improved methods of sampling and analysis of atmospheres, (b) additives to decrease the degradation of monoethanolamine (MEA) in the CO_2 scrubber, and (c) a system for maximum utilization of the carbon in the main ventilation filter. Other topics covered include the use of algae for oxygen production and carbon dioxide absorption, a study of water-thinned fire-retardant paints, and a differentiation scheme for look-alike carbon and catalysts. (auth)

29752 SECOND DERIVATIVE OF FLUX DIGITAL CONTROL OF A SPACE REACTOR FROM SOURCE LEVEL TO CRITICAL. Wayne A. Dempler (Westinghouse Electric Corp., Pittsburgh). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 117-25(Feb. 1965).

A subcritical automatic start control concept is presented for a space reactor which has reactivity inserted in steps. The control parameter is the second derivative of the flux and is negative when subcritical and positive when supercritical. Control is then independent of specific flux at source level and at critical, thereby minimizing the instrument calibration necessary. Further, control on the second derivative provides as an output the state of the reactor, with no dependence upon criticality occurring at some physical position of the control elements. A digital method of implementation of this control is included, using sample data techniques to compute the second derivative from fission counter outputs. (auth)

29753 SNAP REACTOR CONTROL-DRUM ACTUATORS. I. Rowe (Atomics International, Canoga Park, Calif.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 133-8(Feb. 1965).

The series of control-drum actuators (synchronous inductor motors) developed for SNAP reactors is described, and the results of tests on several actuators are presented. (D.C.W.)

29754 REVIEW OF SOLID CORE NUCLEAR ROCKETS. Francis C. Schwenk (Atomic Energy Commission, Washington, D. C.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 160-8(Feb. 1965).

The programs underway to develop solid-core reactor technology for nuclear rockets are reviewed, including the KIWI, NERVA, and PHOEBUS projects on graphite systems, as well as efforts on reactors using fuel in tungsten. (D.C.W.)

29755 LIQUID/GAS REACTORS FOR HIGH ACCELERATION PROPULSION. D. E. Knapp (Douglas Aircraft Co., Inc., Santa Monica, Calif.). IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 169-76(Feb. 1965).

Liquid- and gaseous-core nuclear engines aim at higher specific impulse by removing the melting point limit on solid fuel elements. The problem of separation of fuel and propellant then becomes the major criterion for feasibility of these advanced engine concepts. Proposals to achieve separation by centrifugal forces, regeneratively cooled partitions, and fluid dynamic flows are reviewed. Of these systems, fluidized beds are closest to assured feasibility, but offer the smallest performance increase over solid-core systems. Liquid core concepts offer significant difficulty with modest performance gains, while gaseous core systems indicate substantial improvements in performance along with serious questions of feasibility. Conceptual approaches to separation problems in gaseous core reactors are reviewed, along with problems of energy transfer between fuel and propellant as well as reactor criticality. Establishment of feasibility of any one concept will require significantly better understanding of the interaction among the fuel retention mechanism, radiant energy transfer, and criticality characteristics. (auth)

29756 DESCRIPTION OF THE KIWI-TNT EXCURSION. L. D. P. King (Los Alamos Scientific Lab., N. Mex.). Trans. Am. Nucl. Soc., 8: 126(May 1965).

29757 ANALYSIS OF THE KIWI-TNT EXPERIMENT. W. R. Stratton (Los Alamos Scientific Lab., N. Mex.), D. M. Peterson, and P. M. Altomare. Trans. Am. Nucl. Soc., 8: 126-7(May 1965).

29758 KIWI-TNT— EVALUATION OF ENVIRONMENTAL EFFECTS. Harry S. Jordan, Robert V. Fultyn, Richard W. Henderson, and Philip K. Lee (Los Alamos Scientific Lab., N. Mex.). Trans. Am. Nucl. Soc., 8: 127(May 1965).

29759 PIN TECHNIQUE FOR DISPLACEMENT MEASUREMENTS IN KIWI-TNT. Beverly Washburn (Los Alamos Scientific Lab., N. Mex.) and Charles Hudson. Trans. Am. Nucl. Soc., 8: 127-8(May 1965).

29760 DEVELOPMENT OF SNAP-10A EXPANSION COMPENSATOR. S. Sudar (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 8: 149(May 1965).

29761 DEVELOPMENT OF HIGH-FLUX RADIANT HEATERS FOR THE SNAP-10A GROUND TEST PROGRAM. Robert Blevitt (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 8: 150-1(May 1965).

29762 HYDROGEN REDISTRIBUTION IN THE SNAP-10A REACTOR. N. K. Simon (Atomics International, Canoga, Park, Calif.). Trans. Am. Nucl. Soc., 8: 152-3 (May 1965).

29763 SNAP-10A REACTOR ANALYSIS. J. P. Hawley and W. A. Flynn (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 8: 160(May 1965).

29764 THE DEVELOPMENT OF THE SNAP-10A THERMOELECTRIC PUMP. Milton A. Perlow and Karl A. Davis (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 8: 160-1(May 1965).

29765 OPERATING CAPABILITIES AND GROWTH POTENTIAL OF THE SNAP-8 REACTOR. Leonard M. Maki and Howard R. Brager (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 8: 161-2(May 1965).

29766 A THERMIONIC-REACTOR SPACE POWER PLANT. F. A. Ross and T. F. Plunkett (Douglas Aircraft Co., Inc., Santa Monica, Calif.). Trans. Am. Nucl. Soc., 8: 162-3(May 1965).

29767 SPACE POWER SUPPLIED UTILIZING A STATIC FAST-REACTOR HEAT SOURCE. R. W. Deutsch (Hittman Associates, Inc., Baltimore). Trans. Am. Nucl. Soc., 8: 163(May 1965).

29768 COMPARISON OF POWER-CONVERSION SYSTEMS AND LUNAR NUCLEAR POWER PLANTS. W. D. Pouchot, W. J. Severson, and D. R. Roberts (Westinghouse Astronuclear Lab., Pittsburgh). Trans. Am. Nucl. Soc., 8: 163-4(May 1965).

29769 STUDY OF REFLECTOR-BASED CONTROL OF FAST NUCLEAR ROCKET REACTORS. Kazys K. Almenas (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 165-6(May 1965).

29770 STATUS OF NERVA TESTING PROGRAM. W. L. Knecht, L. Boman, L. Ortenberg, M. Wright, W. H. Esselman and W. H. Arnold (Westinghouse Astronuclear Lab., Pittsburgh). Trans. Am. Nucl. Soc., 8: 166(May 1965).

29771 HIGH-TEMPERATURE THERMOELECTRIC SYSTEMS FOR SPACE POWER AT MULTI-kwe LEVELS. W. H. Hedley and H. R. Strop (Monsanto Research Corp., Dayton, Ohio). Trans. Am. Nucl. Soc., 8: 167-8(May 1965).

29772 COMPARISON OF NERVA HEATING RATES CALCULATED BY VARIOUS METHODS. H. C. Woodsum.

M. A. Capo, and H. C. Romesburg (Westinghouse Astronuclear Lab., Pittsburgh). Trans. Am. Nucl. Soc., 8: 189-90 (May 1965).

29773 CRITICAL EXPERIMENTS IN SUPPORT OF THE FIRST NERVA REACTOR. W. P. Kovacik, C. E. Barksdale, W. D. Rankin, and W. E. Freidhof (Westinghouse Astronuclear Lab., Pittsburgh). Trans. Am. Nucl. Soc., 8: 266-7(May 1965).

29774 CONTROL DEVICE FOR CONTROL AND SAFETY RODS FOR NUCLEAR REACTORS. Marc Alfred (to Commissariat à l'Énergie Atomique). Canadian Patent 681,350. Mar. 3, 1964. Priority date Feb. 5, 1960, France.

A control device for a nuclear reactor having a longitudinally movable control rod is described for particular application for the pressurized water type reactor installed on board ship. The control device consists of two axially aligned reluctance motors and nut and screw devices driven by the motors. Latch means are also provided for releasably holding the control rod in a predetermined position on one end of the screw means for unitary movement when a nut is rotated by the first motor. Means affixed to the screw and movable upon rotation of the screw by the second motor release the latch and permit the control rod to move axially into the reactor. (B.L.M.)

29775 MOUNTING DEVICE FOR FUEL ELEMENT ASSEMBLIES IN A NUCLEAR REACTOR. Claude Hespel and Joseph Olivier (to Commissariat à l'Énergie Atomique). Canadian Patent 692,356. Aug. 11, 1964. Priority date Oct. 14, 1960, France.

A mounting device for fuel element assemblies particularly applicable to pressurized marine reactors consists of a head and a cylindrical guide tube. The head is located in a recess in the upper grid of the reactor and is provided at its upper part with a collar member forming an abutment and at its lower part with apertures for receiving pawls pivoted about horizontal axes. The head is of parallelipiped shape and is machined along its axis. The cylindrical guide tube is partly introduced into the machined bore of the head and moves the pawls into contact with the lower edge of the recess. Locking means are provided between the head and the guide tube. The ends of the fuel elements can be secured by means of flanges to the lower part of the head and to a ferrule member freely slidable in a recess in the lower grid of the reactor. The head is rigidly fixed to the upper grid; the collar member rests under gravity on the upper edges of the grid; and the pawls, held by the guide tube, rest against the lower edge of the grid. Expansion of the elements occurs freely downward with the ferrule moving to a greater or lesser depth in the recess in the lower grid as a result of the frictional forces present. The introduction of fuel can take place without the dismantling of the mounting device except for the cover of the tank. (B.L.M.)

Research and Test Reactors

Refer also to abstracts 28877 and 29735.

29776 (AERE-R-4891) FLOW UP THE INNER TUBE OF A DIDO-TYPE Mk. 3/2 FUEL ELEMENT. Katharine K. George (Atomic Energy Research Establishment, Harwell (England)). Apr. 1965. 25p. Dep.; $0.70(BIS), 3s. 6d. (HMSO).

The Mk. 3 fuel elements for the DIDO type Materials-Testing Reactors have a hollow core into which rigs may be inserted. Thimbles for containing the rigs form, with the inner tube of the fuel element, an annular channel up which travels a proportion of the total coolant flow supplied to the fuel element. It is found that with the standard entry cone fitted to the inner tube, the flow which passes up the inner tube is a constant proportion of the total flow supplied. The proportion is, however, dependent upon several other variables, and a description is given of these and the extent of their effect. An outline is presented of the points to consider if a value of absolute flow is required. The work covers the use of a standard 2⅛ in. diameter thimble only, and includes the effect of variation in diameter over the normal working tolerances. The only non-standard effect treated is that of opening out the entry hole to the inner tube. The effect of complete removal of the thimble is included. (auth)

29777 (BNWL-2) PRTR SECOND GENERATION SHIM ASSEMBLY. D. E. Rasmussen (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Nov. 1964. Contract AT(45-1)-1830. 51p. Dep.; $3.00(cy), 1(mn) CFSTI.

The design, fabrication, assembly, and testing of a second generation shim rod assembly prototype for use in the Plutonium Recycle Test Reactor are discussed. The design used Zircaloy-2 lead screws, rotary limit switches and synchro position indication. Comprehensive out-of-reactor testing of the second generation assembly was completed on environmental test facility. No failure of the assembly occurred during this testing. (L.B.S.)

29778 (HW-74346) NUCLEAR PARAMETERS—PRTR MIXED OXIDE FUEL SAFEGUARDS ANALYSIS. R. E. Peterson (General Electric Co., Richland, Wash. Hanford Atomic Products Operation). July 18, 1962. Contract AT(45-1)-1350. 11p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

The nuclear characteristics of the PRTR uniformly loaded with mixed plutonium- and uranium-dioxide fuel are analyzed, in order to determine the safety hazards involved in this type of fueling configuration. The characteristics are compared with those for the case of zone or spike loading. (T.F.H.)

29779 (HW-84229(Rev.)) PRTR PRIMARY SYSTEM RADIATION STUDY. J. A. Stoddard (General Electric Co., Richland, Wash. Hanford Atomic Products Operation). Sept. 28, 1964. Contract AT(45-1)-1350. 19p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

A study is presented whose purpose is the determination of: the rate of radiation increase in PRTR piping, the source of the radiation, and information necessary for a decision on decontamination of the facility. (T.F.H.)

29780 (INR-580/V) OBLICZANIE AKTYWNOSCI BETA I GAMMA PRODUKTOW ROZSZCZEPIENIA POWSTAJACYCH PODCZAS KILKULETNIEJ PRACY NIECIAGLEJ REAKTORA. (Calculation of Beta and Gamma Activities of Fission Products Formed in a Reactor Operating Discontinuously for Several Years). Tadeusz Zelenay and Wiktor Smulek (Institute of Nuclear Research, Warsaw (Poland)). Nov. 1964. 21p. CFSTI.

Taking into account the weekly build-up and decay of fission products during the nearly 5-years discontinuous operation period of a fuel unit of the reactor EWA, their beta and gamma activities after about five-year cooling time were calculated. (auth)

29781 (NP-14588) HAZARDS SUMMARY REPORT FOR THE UNIVERSITY OF WISCONSIN NUCLEAR REACTOR. Revised for 250 Kw Operation by: R. J. Cashwell (Wisconsin Univ., Madison. Dept. of Nuclear Engineering). Apr. 1964. 152p. (DOCKET-50-156). Dep.(mn); $5.00 (cy), 3(mn) CFSTI.

A description is given of the University of Wisconsin nuclear reactor, the experimental facilities, the building, and the site; and the operational and administrative procedures, a list of experiments which are planned, and an evaluation of the hazards involved are reported. (L.B.S.)

29782 (ORNL-TM-1079) OAK RIDGE RESEARCH REACTOR QUARTERLY REPORT, OCTOBER, NOVEMBER, AND DECEMBER OF 1964. W. R. Casto and W. H. Tabor (Oak Ridge National Lab., Tenn.). Mar. 12, 1965. Contract W-7405-eng-26. 28p. Dep.(mn); $2.00(cy), 1(mn) CFSTI.

The ORR established its best operating record to date by being at power 90.55% of the time. Scheduled shutdowns were responsible for 96.4% of the downtime. A second composite chamber having both a compensated and an uncompensated section was placed in service.

All but four of the neoprene-type gaskets (Koroseal) in the reactor water system between the strainer and the reactor tank were replaced with asbestos-type gaskets. The Koroseal that protruded into the inlet water lines at the two inlets to the reactor was trimmed away. A total of 29 irradiated beryllium reflector pieces have been checked for damage; six are unusable, four are questionable, thirteen are damaged but useful for selected service, and six are suitable for general use. (auth)

29783 (PAN-565/IX,XI) MEASUREMENT OF THE PROMPT NEUTRON LIFETIME IN THE MARYLA REACTOR USING NOISE TECHNIQUE. W. Ciechanowicz, L. Labno, and J. Podgorski (Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research). Nov. 1964. 10p. Dep.

Neutron lifetime in the MARYLA reactor was estimated by use of the noise technique. On the basis of data obtained from the photographic record of neutron flux noise, the autocorrelation function and power spectral density were calculated. The transfer function and then β/ℓ ratio were obtained, using the power spectral density. (auth)

29784 (TID-21794) NORA PROJECT PROGRESS REPORT, JULY 1964–MARCH 1965. (Institutt for Atomenergi, Kjeller (Norway)). Mar. 1965. Contract AT(30-1)-2464. 25p. (NC-64). Dep.(mn); $1.00(cy), 1(mn).

The NORA reactor was shut down from June 1964 to Janurary 1965. Preparations for operation as a H_2O-moderated reactor were made during this period. Reactor startup took place during January 1965 using enriched UO_2. Results of limited experimental research during the period are presented. Theoretical work is reported on disadvantage factors which resulted in derivation of an integral calculation method. (J.R.D.)

29785 THE BEAMHOLE LOOP FACILITY FOR IRRADIATION OF ORGANIC LIQUIDS AT THE RESEARCH REACTOR GEESTHACHT (FRG). K. Hattenbach, G. A. Melkonian, and C. Salander (Gesellschaft fur Kernenergieverwertung in Schiffbau und Schiffahrt mbH., Geesthacht, Ger.). Atomkernenergie, 10: 81-5(Mar.-Apr. 1965). (In German)

Development of the loop facility for irradiation of organic liquids at the FRG is discussed. The beamhole section of the loop was entirely reconstructed to avoid trouble with solidification of the circulating liquid during shutdown periods, and the out-of-pile section of the loop was improved, using stainless steel tubing and the more resistant thermocoax heatings. Operation experiences of the loop facility are given in detail, and developments of special construction elements, such as filters, valves, pump seals are described. The loop facility was operated with diphenyl at a flow rate of 0.6 m^3/hr, a system pressure at 7 atm and up to a maximum of 400°C for a period of about 5 months. (auth)

29786 MEASUREMENT OF THE EFFECTIVE NEUTRON TEMPERATURE WITH A NEUTRON-CRYSTAL-SPECTROMETER AT THE TRIGA-MARK II REACTOR. H. Rauch (Atominstitut der Osterreichischen, Hochschulen, Wien, Ger.). Atomkerenergie, 10: 145-9(Mar.-Apr. 1965). (In German)

A simple neutron crystal spectrometer to measure small changes in effective neutron temperature is described. The different correction factors are considered. A more exact method is given to determine experimentally the neutrons of higher-order reflection. A method is also described for avoiding the coherent extinction effect by suitable rotation of the crystal around an axis perpendicular to the reflecting plane. The effective neutron temperature of the TRIGA-Mark II reactor was measured as 303° ± 6°K at the radial and as 315° ± 6°K at the tangential beam hole with the moderator temperature at 293°K. (auth)

29787 THERMAL CALCULATIONS FOR FUEL ELEMENTS OF THE LUCENS REACTOR. N. Cadelli, G. Ciszewski, and R. Naegelin (Therm-Atom SA, Zurich). Neue Tech., 7: 68-78(Apr. 1965). (In French)

Successive studies made to support the thermal design of the fuel element for the Lucens experimental reactor are summarized. The calculations mentioned, based on the research of an optimum plant efficiency, permitted the choice of thermodynamic parameters and determined the configuration of the heat transfer surfaces of the fuel element. Some means used to study the temperature field in the elements are reported and computed temperatures are given. (auth)

29788 SOME ENGINEERING PROBLEMS OF PINSTECH REACTOR COOLING SYSTEM. S. D. Huseini. Nucleus (Lahore), 1: No. 2, 17-19(Apr.-June 1964).

Some of the engineering problems associated with the design and construction of the cooling system of the 5-Mev (thermal) swimming-pool reactor are explained, involving water technology, material selection, and welding procedures. (D.C.W.)

29789 DESIGN AND CONSTRUCTION OF PINSTECH. Shafqat Raza Khan. Nucleus (Lahore), 1: No. 2, 24-6(Apr.-June 1964).

The 5-Mev (thermal) swimming-pool reactor is briefly described, together with the experimental facilities. Construction plans, techniques, and progress are also summarized. (D.C.W.)

29790 NEAR-OPTIMUM SHUTDOWN FOR NUCLEAR REACTORS. J. R. Fredsall (Australian Atomic Energy Commission, Sutherland, New South Wales). Trans. Am. Nucl. Soc., 8: 101(May 1965).

29791 PROBLEMS OF MOTHBALLING THE ORNL GRAPHITE REACTOR. J. A. Cox (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 115-16(May 1965).

29792 STANDBY CONDITION OF THE HWCTR. L. M. Arnett (E. I. du Pont de Nemours and Co., Aiken, S. C.). Trans. Am. Nucl. Soc., 8: 116(May 1965).

29793 FABRICATION AND INSTALLATION OF THE MOLTEN SALT REACTOR EXPERIMENT. W. B. McDonald, C. K. McGlothlan, and B. H. Webster (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 8: 144-5(May 1965).

29794 DESIGN AND OPERATION OF A 1200°F HEATING SYSTEM FOR THE MOLTEN SALT REACTOR EXPERIMENT. T. L. Hudson (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc. 8: 147-8(May 1965).

29795 FARET FUEL ASSEMBLY FLOW TEST LOOP. R. H. Armstrong and F. A. Smith (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 8: 149-50(May 1965).

29796 REACTIVITY MEASUREMENTS IN HECTOR. G. H. Kinchin (United Kingdom Atomic Energy Authority, Winfrith, Eng.). Trans. Am. Nucl. Soc., 8: 260-1(May 1965).

29797 A REACTOR-CORE MODIFICATION TO ENHANCE BEAMS FOR THERMAL-NEUTRON SPECTROMETERS. J. B. Bullock, E. A. Daniels, and J. S. King (Univ. of Michigan, Ann Arbor). Trans. Am. Nucl. Soc., 8: 302-3 (May 1965).

29798 SWIMMING-POOL REACTOR. Paul Ageron (to Commissariat a l'Energie Atomique). British Patent 986,188. Mar. 17, 1965. Priority date Mar. 16, 1963, France.

A swimming pool reactor includes a body of water that is separated by a partition wall into a bottom compartment containing the vertical fuel assemblies constituting the reactor core and a top compartment. Means are provided to withdraw a flow of water having circulated through the core and to return a deactivated portion of it to the top compartment. Closing members are provided in the partition wall vertically above the fuel assemblies for closing off an integral number of openings. Each opening provides a passageway for one of the fuel assemblies. The leakage through the barrier that is formed by the closing members is compensated by the decontaminated portion that is returned to the top compartment. A deactivation tank is provided into which the whole flow of water withdrawn is received, and a heat exchanger is provided to cool that portion of the water returned to the bottom compartment. (B.L.M.)

29799 SELF-CONTAINED LOOP FOR STUDYING MATERIALS UNDER IRRADIATION IN A SWIMMING-POOL REACTOR. Roger Chabassier, Gérard Dupuy, Bernard Lerouge, and Jean Megret (to Commissariat à l'Énergie Atomique). Canadian Patent 679,457. Feb. 4, 1964. Priority date May 20, 1960, France.

A self-contained loop is designed for studying materials under irradiation from a swimming-pool reactor in a definite ambient medium at a definite pressure inside the loop. The gas, e.g. CO_2, circulates in a closed circuit, cools the sample, and is itself cooled in a natural- or forced-circulation heat exchanger. The loop includes a test duct with an accompanying fine-adjustment device for placing the duct in position against the core of the reactor. The test duct has a plug at the top with packings to ensure a fluid-tight seal. From the plug is suspended a basket in which the sample to be irradiated is placed. The basket rests in the duct on two different supports, one a shoulder made in one piece with the duct and the other a fork passing through the walls of the duct above the packing and plug and along two parallel chords. A complex mechanical assembly is provided for rapidly dismantling the test duct. (B.L.M.)

29800 REACTOR PILE UNIT FOR STUDYING MATERIALS UNDER RADIATION. Boris Barabach, Jacques Berger, Gérard Dupuy, Jean Lacour, and Victor Raievski (to Commissariat à l'Énergie Atomique). Canadian Patent 679,458. Feb. 4, 1964. Priority date May 20, 1960, France.

The reactor pile unit for studying materials under irradiation is made up of a pressure-resistant enclosure containing the core of the reactor and equipped with a top cover and cooling water inlet pipes leading to the top of the enclosure and steadying it mechanically. The pipes open into the enclosure via divergent deflectors. The fuel elements are disposed inside a container within the enclosure with means for preventing the fuel elements from vibrating with the high speed water circulation. Sheaths, each containing a control rod, pass through the fuel element container and through a fluid-tight plug passing through the bottom of the bath. Pipes with deflectors remove the cooling water at the bottom of the enclosure, and the external walls of the enclosure are equipped with lead screens with water ducts through them to improve cooling. Means also are provided to prevent the screens from vibrating with water circulation. (B.L.M.)

29801 EXPERIMENTAL IRRADIATION LOOP FOR POOL-TYPE NUCLEAR REACTOR. Victor Raievski (to Commissariat à l'Énergie Atomique). Canadian Patent 685,380. Apr. 28, 1964. Priority date May 20, 1960, France.

The irradiation loop suitable for use with pool-type reactors includes an immersible portion and a non-immersible portion. The immersible portion consists of a heat-insulated pressure tube adapted to contain the element to be irradiated. A reflector for neutrons is disposed in suitable fashion against the pressure tube on a level with the position of the element to be irradiated. A second tube made in two parts and parallel to the pressure tube contains on one hand a filter and on the other hand means for measuring the rate of flow. A three-direction valve connects the parts of the tube by way of a blower and places a temperature-exchanger in communication with the tube. The two tubes are connected by two tubular elements of the same diameter as the tubes to form a closed circuit for an internal fluid at suitable pressure and temperature. The non-immersible portion is made up of an installation equipped with devices for filling the loop with fluid and appliances for regulating the pressure and measuring the radioactivity of the fluid. The non-immersible portion is linked to the immersible portion by flexible detachable pipes. A moving support is also provided for moving the immersible portion into the water, and handling devices are provided for enabling both portions to be disconnected and the immersible portion to be withdrawn from the water. (B.L.M.)

29802 SWIMMING POOL REACTOR FOR STUDYING MATERIALS UNDER IRRADIATION. Jules Horowitz and Victor Raievski (to Commissariat à l'Énergie Atomique). Canadian Patent 686,282. May 12, 1964. Priority date May 20, 1960, France.

A swimming pool reactor is described for studying materials under irradiation. Means are provided for controlling the fuel elements from a position directly below the reactor. The reactor includes a casing formed by a polygonal body having an upper and lower collar and immersed in the pool. The casing has compartments in which the fuel elements of the reactor are located. Carrying means with accompanying driving means are provided for bringing articles for irradiation into the immediate neighborhood of the core. Guides for the carrying means are located at the base of the pool and extend radially relative to the core. The irradiated articles may be observed by x rays, and manipulating means are provided outside the pool for maneuvering the articles without breaking mechanical and electrical connections to equipment outside the pool. (B.L.M.)

WASTE DISPOSAL AND PROCESSING

See also BIOLOGY AND MEDICINE — Ecology.
CHEMISTRY — Radiochemistry.
CHEMISTRY — Separation Processes and Procedures.
HEALTH AND SAFETY.

Refer also to abstracts 29470 and 29620.

29803 (ORNL-3765) RECOVERY OF ^{137}Cs FROM FISSION-PRODUCT WASTES AND TRANSPORT BY AN ALUMINOSILICATE ION EXCHANGER. R. E. Lewis, T. A. Butler, and E. Lamb (Oak Ridge National Lab., Tenn.). May 1965. Contract W-7405-eng-26. 15p. Dep.; $1.00 (cy), 1(mn) CFSTI.

A method for recovering fission-product cesium from aged basic fission-product waste with an aluminosilicate ion exchanger (Decalso) was developed and demonstrated. Cesium is selectively adsorbed on Decalso from Hanford Purex Supernatant 103A, a basic 9 M $NaNO_3$ solution, and concentrated by a factor of about 8.5 The Decalso column is transported from HAPO to ORNL in shielded containers formerly used for shipping solutions, and the cesium is eluted with ammonium salts for purification and source fabrication. In the period April 1961 to August 1964, 2 Mcuries of ^{137}Cs was recovered from Hanford wastes and transported to ORNL by this procedure. (auth)

29804 RADIOTRACER MEASUREMENTS OF THE HYDRAULIC BEHAVIOR OF A LARGE SHALLOW POND. B. A. Fries and I. M. Whittemore (California Research Corp., Richmond). Trans. Am. Nucl. Soc., 8: 78-9(May 1965).

29805 IMPROVEMENTS RELATING TO RADIOACTIVE GAS DECONTAMINATION. John Francis William Smith and Ralph Hugh Alfred Crawley (to English Electric Co. Ltd.). British Patent 985,550. Mar. 10, 1965. Filed July 21, 1960.

A means for removing radioactive iodine from a flowing gas includes a multi-layer mesh of silver-coated copper continuous wire filaments woven together in the flow path of the gas. The silver may be deposited on the copper by electroplating or by direct immersion process. The mesh is particularly applicable to use in the effluent gas duct of a gas cooled reactor. The knitted or woven mesh is stacked in substantially parallel layers in the duct compressing the layers of the bed so that its depth is about 9 in. (B.L.M.)

GENERAL AND MISCELLANEOUS

29806 (ANL-7021) NAMED STORAGE— A DYNAMIC STORAGE-ALLOCATION SCHEME WITH MANIPULATIVE ROUTINES. Stanley Cohen (Argonne National Lab., Ill.). Apr. 1965. Contract W-31-109-eng-38. 35p. Dep.; $2.00 (cy), 1(mn) CFSTI.

A dynamic data-storage allocator is described which results in computer programs more compact and efficient than the usual FORTRAN programs. In the allocator, the operating program is allowed to control completely the use of the storage facilities. (D.L.C.)

29807 (IS-1119) THREE-DIMENSIONAL AND ONE-DIMENSIONAL FREE-ELECTRON MOLECULAR ORBITALS. Richard L. Hummel and Klaus Ruedenberg (Ames Lab., Iowa State Univ. of Science and Tech.). Mar. 3, 1965. Contract W-7405-eng-82. 18p. Dep.(mn); $1.00 (cy), 1(mn) CFSTI.

The free-electron model used in molecular calculations, in which the electrons form waves in a three-dimensional volume, is compared with the model used in solid-state theory, in which the electrons are confined to move along a one-dimensional multiply connected space. The three-dimensional and one-dimensional free-electron waves are compared for the case of a curved-cloud electron distribution, using the example of waves in a toroidal pillbox. The energy eigenvalues and eigenfunctions, in particular for tangential excitations, are compared with those of the corresponding one-dimensional model, for various box parameters. The deviations, in energies and wave functions, of the three-dimensional solutions from the one-dimensional model are markedly smaller than would be expected from considerations of asymptotic behavior, even for a fairly wide torus. (M.J.T.)

29808 (KR-94) QUARTERLY PROGRESS REPORT, OCTOBER– DECEMBER 1964. (Institutt for Atomenergi, Kjeller (Norway)). Mar. 1965. 41p. Dep.(mn).

The operations connected with the JEEP and NORA reactors and the progress of the JEEP II construction are described. Reactor dynamics studies were carried out in NORA. A high-pressure boiling loop and its components are described. The manufacture of sintered enriched UO_2 pellets and an attempt to prepare stoichiometric UO_2 are reported. Results of nondestructive testing of aluminum alloy canning tubes for JEEP II are given. The fabrication of the IFA-24 Al-clad fuel element for irradiation in Halden, is described. Results collapse tests of thin-walled tubing of annealed and half-hard AISI 304 L stainless steel are reported. The effects of cathodic protection by zinc and of stainless steel surface treatment on the corrosion of mild steel were studied. The operation of the reprocessing pilot plant and the waste treatment plant is described. Reprocessing research (Pu purification, Ru chemistry, etc.) and analysis programs are discussed. Activities in radioisotope production and development are described. Health physics activities (personnel and environmental monitoring) are also surveyed. (D.L.C.)

29809 (NYO-10508) ON THE PREDICTION OF THE DISTRIBUTION OF EXCESS TEMPERATURE FROM A HEATED DISCHARGE IN AN ESTUARY. Technical Report No. 33. Reference 65-1. D. W. Pritchard and H. H. Carter (Chesapeake Bay Inst., Johns Hopkins Univ., Baltimore, Md.). Feb. 1965. For Maryland Univ., Solomons. Natural Resources Inst. Contract AT(30-1)-3109. 49p. Dep.(mn); $2.00(cy), 2(mn) CFSTI.

The problem of predicting the probable temperature distribution is considered for the case of the heated effluent discharged from the PEPCO Chalk Point Power Plant (conventional) into the Patuxent River estuary in Maryland. Dye tracer experiments are described, and theoretical correction of the tracer results for the nonconservative heat losses at the surface is considered. The predictions are presented as graphs for upstream and downstream points. (D.L.C.)

29810 (PNE-457) SECOND OCEANOGRAPHIC SURVEY OF THE CHUKCHI SEA. Progress Report as of December 31, 1960. BROWN BEAR Cruise No. 268, July 26 to August 28, 1960. Richard H. Fleming et al. (Washington Univ., Seattle. Dept. of Oceanography). Contract Nonr-477(10). 10p. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Results of analyses and examinations of samples and data gathered in the Chukchi Sea are discussed. Information is included on water movements, bottom sediments, and biological samples. (J.R.D.)

29811 (SCL-DC-65-52) PRINTED CIRCUIT LABORATORY MANUAL. A. D. Andrade and E. E. Alford (Sandia Corp., Livermore, Calif.). Mar. 1965. Contract [AT(29-1)-789]. 83p. Dep.; $3.00(cy), 2(mn) CFSTI.

A description is presented of a laboratory whose purpose is the preparation of printed circuit boards. The manufacturing techniques employed in this laboratory are described on a step-by-step basis. (T.F.H.)

29812 (SRIA-425-4) SORPTION OF GASES ON METAL SURFACES IN ULTRAHIGH VACUUM. Annual Report, February 15, 1964–February 14, 1965. B. Bergsnov-Hansen, N. Endow, and R. A. Pasternak (Stanford Research Inst., Menlo Park, Calif.). Mar. 23, 1965. Contract AT(04-3)-425. 71p. Dep.(mn); $3.00(cy), 2(mn) CFSTI.

Study of the adsorption of nitrogen by molybdenum films was continued. For the low temperature state, which was studied in detail, adsorption occurs with a high sticking probability (about 0.5) and is little dependent on coverage; the saturation amount is independent of pressures, over a pressure range of 10^{-8} to 10^{-4} torr, and is of the order of a monolayer. Physisorption of xenon on molybdenum films at −196 and −186°C occurs with a high initial sticking probability also (about 0.6). The equilibrium amount shows a significant though small pressure dependence, about a factor of 4 over a pressure range of 10^{-8} to 10^{-4} torr. In a study of physisorption of xenon on glass the pressure dependence of the amounts sorbed was found to be about twice that on molybdenum films. The heterogeneous hydrogen-deuterium exchange reaction on a molybdenum filament was investigated at low pressure in a steady-state flow system. A theoretical analysis of the kinetics of surface reactions in a flow system was carried out. Experimental data confirming the formalism were collected. They establish that the rate-determining step for the exchange reaction at elevated temperatures is the adsorption of the three species, H_2, HD, D_2, on a clean surface; their sticking probability appears to be approximately the same, about 0.3, and is independent of temperature. The interaction of coated ion gage filaments with hydrogen and oxygen was studied. ThO_2-coated iridium filaments performed well in both gases; they neither produce significant amounts of CO nor pump them significantly. ThB_6-coated tungsten filaments pump oxygen extensively but are acceptable for hydrogen. (D.L.C.)

29813 (TID-20741) EFFECTS OF CHELATED IRON AND ZINC ON ROUGH LEMON AND TRIFOLIATE ORANGE SEEDLINGS GROWN IN CALCAREOUS AND NONCALCAREOUS SOIL. A. H. Khadr, A. Wallace, and E. M. Romney (California Univ., Los Angeles). [1964]. Dep.(mn); $1.00(cy), 1(mn) CFSTI.

Trifoliate orange seedlings were zinc deficient when grown on noncalcareous or calcareous soil, and they were severely injured by iron chlorosis when grown on calcareous soil. Rough lemon was not subject to these deficiencies when grown on either soil. Zn-EDTA amendment corrected both Zn and Fe deficiencies and Fe-EDDHA corrected Fe deficiency. Among those factors observed in trifoliate orange that might have contributed to its susceptibility for Fe and Zn deficiencies were the high P, high K, and high Ca contents in leaf tissue compared to the low content of these

elements in rough lemon, which has a high degree of resistance to Fe and Zn deficiencies. (P.C.H.)

29814 (UCRL-7806) LOMMEL FUNCTIONS OF IMAGINARY ARGUMENT. Robert E. Shafer (Lawrence Radiation Lab., Univ. of California, Livermore). Apr. 8, 1964. Contract W-7405-eng-48. 10p. Dep.(mn); $1.00 (cy), 1(mn) CFSTI.

The function $T_{\mu,\nu}(z)$, with complex parameters μ, ν, and complex argument z, is adopted for the general solution of the inhomogeneous differential equation $z^2d^2T/dz^2 + zdT/dz - (z^2 + \nu^2)T = z^{\mu+1}$. It is shown that, if $\mu + \nu$ or $\mu - \nu$ is an odd positive integer, then a finite polynomial solution exists, corresponding to the asymptotic solution $T_{\mu,\nu}(z) \sim -z^{\mu-1}\{1 + [(\mu-1)^2 - \nu^2]/z^2 + [(\mu-3)^2 - \nu^2]/z^2 + \ldots\}$. (M.J.T.)

29815 (WAPD-T-1695) THIRD-ORDER TIME-VARYING SYSTEMS. W. C. Bean (Westinghouse Electric Corp., Pittsburgh, Pa. Bettis Atomic Power Lab.). Mar. 1964. Contract AT-11-1-GEN-14. 9p. (CONF-650105-1). Dep.(mn); $1.00(cy), 1(mn) CFSTI.

From Conference on Symmetry Principles at High Energy, Coral Gables, Fla.

General solutions to a specific class of time-variable coefficient differential equations are presented. The reduction of the third-order equations $\dddot{x} + a\ddot{x} + b\dot{x} + c(t)x = 0$, $\dddot{x} + a\ddot{x} + b(t)x + c(t)x = 0$, and $\dddot{x} + a_1(t)\ddot{x} + a_2(t)\dot{x} + a_3(t)x = 0$ is considered. The solutions of these classes of equations are found applicable in adaptive-systems behavior for automatic control engineering. (M.J.T.)

29816 (Y-PB-98) CRITICAL PATH SCHEDULING AS APPLIED TO SPECIAL FABRICATION AT THE OAK RIDGE Y-12 PLANT. F. E. Baker, N. H. Bethea, and A. L. Strickland (Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant). May 1965. Contract W-7405-eng-26. 56p. Dep.(mn); $3.00(cy), 2(mn) CFSTI.

A description is given of the Critical Path Method, a network-analysis technique, and its application in planning and scheduling the activities in the startup of new fabrication programs at Y-12. (D.L.C.)

29817 LICENSING PROCEDURES AND SAFETY EVALUATIONS (LEGAL PRINCIPLES, TASKS OF THE CONFEDERATION COMMISSION FOR THE SAFETY OF ATOMIC INSTALLATIONS PREVIOUS EXPERIENCE). F. Alder. Neue Tech., 7: 55-62(Apr. 1965). (In German)

The legal bases for the licensing procedures for construction and operating nuclear installations are reviewed, and these procedures are discussed in detail. The practical implications are demonstrated by examples. (auth)

29818 PROTECTION OF ELECTRICAL CONNECTOR CONTACT PINS. F. X. Daut and R. O. Work (to U. S. Atomic Energy Commission). U. S. Patent 3,182,280. May 4, 1965.

A method is given for protecting electrical connector contact pins against being bent or splayed, from time of connector origin through subsequent handling, storage, and processing to ultimate connector use. Contact pin-bearing electrical connectors are provided with pin protecting caps capable of being secured to the connectors in such a manner that rigid dielectric portions of the caps envelope essentially the full "free-length" of each individual pin to maintain the pins in proper alignment until the connectors are to be tested or attached to mating connector portions. These caps also attach to the connector in such manner as to provide an environmental seal for preventing foreign matter from reaching the contact pins. (AEC)

29819 METHOD OF MEASURING WIND VELOCITY. Harry Moses (to U. S. Atomic Energy Commission). U. S. Patent 3,182,499. May 11, 1965.

In the method, infrared radiation is generated and transmitted into the atmosphere to heat a portion thereof. The heated portion of the atmosphere is monitored at measured time intervals to determine the spatial coordinates thereof. The velocity of the heated portion of the atmosphere is computed from the determined spatial coordinates and time intervals to give a value of wind velocity. (AEC)

29820 HIGH DIRECTIVITY SOLID CURTAIN PERIMETER INTRUSION SYSTEM. R. G. Cowen (to U. S. Atomic Energy Commission). U. S. Patent 3,183,499. May 11, 1965.

A system is designed for the detection of intrusion by large or very thin objects or even smoke into a protected area such as a room. An elongated lamp source at one end of the protected area and a bank of photoresistors at the other end of the protected area lie in a plane which defines a curtain of light between the lamp and photoresistors. The individual photoresistors are arranged to receive light from individual segments of the lamp so that interruption of the light from only a segment of the lamp results in an alarm. The device is stable against normal variations in temperature, line voltage, or light intensity, while being responsive to failure in either the voltage or light source. The device can be completely battery operated and can detect objects having a thickness of a fraction of an inch. (AEC)

29821 EXPANSION JOINT. Rudolph Michel (to U. S. Atomic Energy Commission). U. S. Patent 3,183,936. May 18, 1965.

An expansion joint of the sliding type is designed which eliminates end thrust due to thermal expansion and fluid pressure, or limits the thrust to a desired amount in a system carrying a fluid under pressure. In the expansion joint, a first chamber formed by sleeves communicates with a second chamber formed by sleeves. End thrust is limited by pressuring the first chamber by the transported fluid. The fluid in the second chamber is vented in order to control the rate of separation of the two sleeves in a slidable expansion joint. (AEC)

29822 MINI-CAM TRACER PLATE. Edward J. Sass (to U. S. Atomic Energy Commission). U. S. Patent 3,184,849. May 25, 1965.

In the cam tracer plate, an arm is pivotally mounted on a corner of a plate, the arm being capable of moving a control stylus until the control stylus encounters a cam means, the control stylus thereafter moving along the surfaces of the cam. (AEC)

29823 MAGNETICALLY ACTUATED SHUTTER. F. C. Ford, E. B. Nelson, W. M. Trimble, and S. Zizzo (to U. S. Atomic Energy Commission). U. S. Patent 3,185,063. May 25, 1965.

The magnetic shutter comprises a thin-walled electrically conductive tube disposed in the shutter position of a high-speed camera. The tube is disposed within a solenoid connected to a capacitor bank. When the capacitor bank is discharged through the solenoid, the rising magnetic field pressure collapses the tube, thus terminating passage of light. Shutter speeds of the order of 10 microseconds are obtained with this arrangement. (AEC)

29824 BLOOD PRESSURE INDICATING DEVICE. Paul Salz, M. B. Bacaner, and N. W. Yanni (to U. S. Atomic Energy Commission). U. S. Patent 3,189,023. June 15, 1965.

An electrical instrument for continuously measuring changes in blood pressure that comprises a compact unit clampable on a blood vessel and having a primary and a secondary coil disposed on opposite sides of the blood vessel is described. The unit includes compression springs urging the two coils together so that the blood vessel is slightly flattened. The spacing between the coils is thus affected by the pressure of blood within the vessel, the mutual inductance between the two coils changing with variations in blood pressure. An alternating current signal applied to the primary coil induces a potential in the secondary, the amplitude of which is measured as an indication of blood pressure. (AEC)

29825 ZONE-MELTING CRYSTALLIZATION TECHNIQUE. William R. Wilcox (to U. S. Atomic Energy Commission). U. S. Patent 3,189,419. June 15, 1965

A method and apparatus for stirring the solution in fractional crystallization processes, such as zone-melting,

where mechanical stirring is not feasible, is described. This is accomplished by introducing a stationary foreign body, such as a rod, tube, or electrical leads into the solution near the surface of the growing crystal, the body being a different temperature from the surrounding fluid. Because of the temperature difference free convection currents are generated that stir the liquid material and effect greater separation of compounds thus increasing the efficiency of this process. (AEC)

29826 CONTINUOUS SOLUTION CONCENTRATOR. Kenneth J. Schneider (to U. S. Atomic Energy Commission). U. S. Patent 3,191,662. June 29, 1965.

A continuous solution concentrator that avoids the significant build-up of solids on the concentrator surfaces by producing a concentrated liquid product rather than a dried solid is described. The concentrator includes a heated outer cylindrical wall and inner unheated cylindrical wall of insulating material into which liquid to be concentrated is downwardly directed in atomized form by a spray nozzle. Because the inner wall is unheated and formed of insulating material, the liquid on coming from the nozzle does not deposit solid material on the inside of the wall. The gas and entrained liquid exiting from the lower end of the inner wall rises in the space between the walls, because, being heated by the outer wall, the gas and liquid between the walls are less dense than the gas and liquid within the unheated inner wall. (AEC)

29827 MEMBRANE DOUBLE WALL INTERCONNECTED PRESSURE VESSEL. David A. Hunt (to U. S. Atomic Energy Commission). U. S. Patent 3,191,792. June 29, 1965.

Description is given of a lightweight envelope with particular application for space vehicles in which the walls of the envelope consist of adjacent cells in which the outer and inner walls of the envelope are outwardly convex relative to each other, the parameters of the cell being mathematically optimized for strength and lightness. (AEC)

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DIVISION OF TECHNICAL INFORMATION EXTENSION (AEC), OAK RIDGE, TENN.
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EUROPEAN ATOMIC ENERGY COMMUNITY, ISPRA (ITALY). EUROPEAN SCIENTIFIC DATA PROCESSING CENTER.
Code for hydraulic and thermal study of fuel elements, 19: 29471 (EUR-2289.f)
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EUROPEAN ATOMIC ENERGY COMMUNITY, ISPRA (ITALY). JOINT NUCLEAR RESEARCH CENTER.
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EUROPEAN COMPANY FOR THE CHEMICAL PROCESSING OF IRRADIATED FUELS, MOL (BELGIUM).
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EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH, GENEVA (SWITZERLAND).
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GENERAL DYNAMICS/FORT WORTH, TEX.
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GENERAL ELECTRIC CO., CINCINNATI, OHIO. NUCLEAR MATERIALS AND PROPULSION OPERATION.
Nuclear propulsion, Lecture 1, 19: 29737 (GEMP-190A)
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GEOTECHNICAL CORP., GARLAND, TEX.
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GOSUDARSTVENNYI KOMITET PO ISPOL'ZOVANIYU ATOMNOI ENERGII SSSR.
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GRONINGEN RIJKSUNIVERSITEIT (NETHERLANDS).
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GRUMMAN AIRCRAFT ENGINEERING CORP., BETHPAGE, N. Y.
Cosmic-ray collisions in space. IV., 19: 29014 (NASA-CR-151)

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HAMBURG UNIV. (WEST GERMANY). I. INSTITUT FUR EXPERIMENTAL-PHYSIK.
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HOKKAIDO UNIV., SAPPORO (JAPAN). FACULTY OF SCIENCE.
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INSTITUTE FOR NUCLEAR STUDY, TOKYO UNIV. (JAPAN).
Analysis of high-energy jets. IV., 19: 29012 (INSJ-84)
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INSTITUTE OF PLASMA PHYSICS, UNIV. OF NAGOYA (JAPAN).
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INSTITUTO DE ENERGIA ATOMICA, SAO PAULO (BRAZIL).
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LIEGE UNIV. (BELGIUM).
Accelerator targets for neutron generation, 19: 28945 (EUR-1815.e(Rev.)(p.182-5))
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MEDICAL RESEARCH COUNCIL, HARWELL (ENGLAND). RADIOBIOLOGICAL RESEARCH UNIT.
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Because of problems involving the mechanical preparation of this index, all accent marks are omitted. The following changes in spelling have been introduced to reduce some of the confusion which might result from omitting the accents:

ä	becomes	ae
ö		oe
ø		oe
ü		ue (except in transliterated Chinese names)

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SUBJECT INDEX

Main entries in this index are generally specific materials, things, and processes. These are followed by modifiers that describe the properties of, and processes applied to, the main entries.

The number preceding the colon is the *NSA* volume number, and the number following is the abstract number. The designation (R) following the abstract number indicates that the abstract is of a progress report; (P) indicates a patent; and (T) indicates a translation. Abstracts for reports other than progress reports carry no letter designation. References to report numbers, where appropriate, are included after the abstract number of the citation. Published literature (journal article or book) is identifiable by the absence of a report number.

The user should bear in mind that the ideas presented in the original literature, rather than key words, have been indexed. The indexers have tried to select what seemed the most probable and logical place to look for typical information. Since it is not possible to anticipate where a user would look for information, numerous cross references are included to assist him in his search.

Experience in using an index of this type will be the best guide in obtaining the desired information, and a consideration of synonymous or closely related terms will prove valuable.

Information must be so indexed as to be of the greatest use to the greatest number of users. This requires that a topic be indexed to headings that most specifically describe it and not ordinarily to the headings that describe its ultimate use, nor to the general class headings that include the specific headings. For example, information on the treatment of thyroid disease with I-131 would be indexed under Thyroid Diseases and under Iodine Isotopes I-131, but not necessarily under Radiotherapy. A study of the effects of x radiation on hair would be indexed under both X Radiation and Hair.

The broad, general class headings are used only for general information or for comprehensive reports or articles.

Subject Heading Styles

Generally, the direct form of subject entry is used rather than inverted headings or, in some cases, subheadings; e.g., Amino Acids rather than Acids, amino; Helium Isotopes He-4 rather than Helium — isotopes He-4 or Helium — He-4 isotopes. Note, however, that in some cases modifying terms are used parenthetically in preference to a more direct type of entry which would result in the scattering of information. Organic compounds, however, are usually entered in the index in the inverted form so that substituted compounds can be listed near the parent compound; e.g., Benzene, Bromo- rather than Bromobenzene. In general, the style of nomenclature used is that of *Chemical Abstracts*, except that some items listed in that publication as subheadings are elevated to form part of the main heading; e.g., Butyric Acid, Methyl Ester rather than Butyric Acid — methyl ester.

Alphabetization

Main headings are arranged according to the widely accepted word-by-word alphabetic system. A parenthetic qualifier following a main heading is disregarded in alphabetizing unless there are two or more headings identical except for the parenthetic qualifier, in which case the qualifier determines the order. Headings involving Greek letters are arranged as if the names of the letters were spelled out, e.g., Mesons (π), Mesons (ξ).

Nomenclature of Inorganic Compounds

Inorganic compounds are indexed in the direct form, listing cations in the order of increasing valence in the case of polycationic salts of varying valence and in alphabetic order for polycationic salts in which all cations have the same valence; e.g., Sodium Aluminum Silicates and Potassium Sodium Sulfates.

Multicomponent Systems

Multicomponent alloys, except well-known trade names are indexed under each element in the alloy.

Example: Aluminum–Chromium Alloys are indexed

ALUMINUM ALLOYS
Al–Cr ...
CHROMIUM ALLOYS
Al–Cr ...

Well-known alloys such as Hastelloy are indexed directly. Cross references appear in the index cumulations. Multicomponent systems of elements are indexed similarly.

Example: Silicon–Tungsten Systems are indexed

SILICON SYSTEMS
Si–W ...
TUNGSTEN SYSTEMS
Si–W ...

Multicomponent systems of compounds are similarly indexed under the compound.

Physical States of Materials

Specification of the physical state of the material, if other than normal, is included in the modifying phrase.

Modifying Phrases (Subheadings)

Whenever it appears that such information would be useful, descriptive phrases (modifiers), rather than ordinary subheadings, are used under the main headings to give a better indication of the material covered in an abstract. Such phrases are written so that the idea considered most important is presented first. However, when using this index, the reader is advised to scan all modifiers under a main heading to determine whether any abstracts in addition to the most obvious should be consulted for the desired information. Many of the modifiers are designed to be read in inverted order or to be read with the main heading inserted at the position of the comma in order to obtain a meaningful phrase; e.g., Uranium — allotropic transformation temperatures of, effect of cooling rate on is read "effect of cooling rate on allotropic transformation temperatures of uranium." In many cases, the prepositions have been omitted from such phrases provided no ambiguity results from the omission.

For entries concerned with physics, if the modifier does not indicate whether the reference is experimental or theoretical, a symbol E or T or E/T is given.

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Proceedings of conferences and conference papers are included in the Report Number Index.

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428	19-29616	Dep.(mn); $3.00(cy), 2(mn) CFSTI
430	19-29617	Dep.(mn); $2.00(cy), 1(mn) CFSTI
434	19-29469	Dep.(mn); $3.00(cy), 2(mn) CFSTI
436	19-29618	Dep.(mn); $3.00(cy), 1(mn) CFSTI
437	19-29619	Dep.(mn); $1.00(cy), 1(mn) CFSTI
439	19-28573	Dep.(mn); $1.00(cy), 1(mn) CFSTI
442	19-29620	Dep.(mn); $2.00(cy), 1(mn) CFSTI
APDA–	**(Misc.)**	
167	19-28284	Dep.(mn); $2.00(cy), 1(mn) CFSTI
APDA-NTS		
2	19-29621	Dep.(mn); $2.00(cy), 1(mn) CFSTI
APEX–		
502	19-29438	Dep.(mn); $2.00(cy), 1(mn) CFSTI
APS–	**(Non-AEC)**	
5152-R1(Suppl.1)	19-29731	

Report No.	Abstract No.	Availability
5152-R2	19-29732	
ARF–	**(Misc.)**	
3203-3	19-28218	See AD-608438
ARL–	**(Non-AEC)**	
65-10	19-28989	CFSTI
65-18	19-28493	CFSTI
65-73	19-29388	CFSTI
AROD–	**(Misc.)**	
3816.1	19-28625	
ASE–	**(Non-AEC)**	
608	19-29131	$2.00(CFSTI)
AWRE-O–	**(British)**	
46/65	19-27911	Dep.(mn); $0.50(BIS), 2s. 6d. (HMSO)
BM-RI–	**(Misc.)**	
6619	19-28810	Free(Bureau of Mines)
6624	19-28737	Dep.(mn); $1.00(cy), 1(mn) CFSTI
6635	19-28437	Free(Bureau of Mines)
BMI-X–		
10096	19-28773	Dep.(mn); $2.00(cy), 1(mn) CFSTI
10119	19-28574	Dep.(mn); $1.00(cy), 1(mn) CFSTI
10121	19-28870	Dep.(mn); $1.00(cy), 1(mn) CFSTI
BNL–		
889	19-28418	Dep,; $6.00(cy), 4(mn) CFSTI
918	19-29229	Dep.; $1.00(cy), 1(mn) CFSTI
8677	19-28932	Dep.(mn); $1.00(cy), 1(mn) CFSTI
8777	19-28311	J. Chem. Phys., 43: 149-54(1965)
8857	19-28883	Phys. Rev., 139: A118-25(1965)
8914	19-28933	Dep.(mn); $1.00(cy), 1(mn) CFSTI
8937	19-28934	Dep.(mn); $1.00(cy), 1(mn) CFSTI
8971	19-28935	Dep.(mn); $1.00(cy), 1(mn) CFSTI
8983	19-28936	Dep.(mn); $1.00(cy), 1(mn) CFSTI
9003	19-29576	Dep.(mn); $1.00(cy), 1(mn) CFSTI
9032	19-28419	Dep.(mn); $1.00(cy), 1(mn) CFSTI
9043	19-28360	Dep.(mn); $2.00(cy), 1(mn) CFSTI
9057	19-28937	Dep.(mn); $1.00(cy), 1(mn) CFSTI
9173	19-28575	Dep.(mn); $1.00(cy), 1(mn) CFSTI
9174	19-28361	Dep.(mn); $1.00(cy), 1(mn) CFSTI
BNWL–		
2	19-29777	Dep.; $3.00(cy), 1(mn) CFSTI
12	19-28220	Dep.; $1.00(cy), 1(mn) CFSTI
41	19-28725	Dep.(mn); $1.00(cy), 1(mn) CFSTI
CALT–		
68-2	19-29040	Dep.(mn); $1.00(cy), 1(mn) CFSTI
68-28	19-29041	Dep.(mn); $1.00(cy), 1(mn) CFSTI
CAPE–		
1174	19-28483	EM
1194	19-28338	EM
1195	19-28216	EM
1199	19-28607	EM
1219	19-28522	EM
CEA-R–	**(French)**	
2475	19-29502	Dep.(mn)
2561	19-29503	Dep.(mn)
2710	19-29715	Dep.(mn)
2719	19-29622	Dep.(mn)
2720	19-28568	Dep.(mn)
2730	19-29230	Dep.(mn)
2745	19-28938	Dep.(mn)
2754	19-28479	Dep.(mn)
2764	19-29716	Dep.(mn)
CEA-tr–	**(French)**	
R-1818	19-28480	Dep.(mn); $1.60(fs), $0.80(mf) JCL
R-1821	19-28481	Dep.(mn); $1.10(fs), $0.80(mf) JCL
CEND–		
529	19-28213	Dep.(mn); $5.00(cy), 4(mn) CFSTI

Report No.	Abstract No.	Availability
CERN–	**(European Organization for Nuclear Research)**	
65-1	19-28939	Dep.(mn)
65-2	19-28940	Dep.(mn)
65-6	19-29231	Dep.(mn)
65-8	19-28941	Dep.(mn)
65-12	19-29042	Dep.(mn)
65-16	19-28726	Dep.(mn)
CEX–		
63.3	19-29439	Dep.; $1.00(cy), 2(mn) CFSTI
CLM-R–	**(British)**	
42	19-29389	Dep.(mn); $1.10(BIS); 5s. 6d. (HMSO)
CNAEM–	**(Turkish)**	
22	19-28913	Dep.(mn)
CONF-52–	19-29344	**(Proceedings of the Second International Conference on Nuclidic Masses, Vienna, July 1963)**
CONF-446–	**(American Nuclear Society 10th Annual Meeting, Philadelphia, June 1964)**	
80	19-29623	Dep.(mn); $1.00(cy), 1(mn) CFSTI
CONF-469–	**(Conference on Physics of Reactors, Milan, Nov.–Dec. 1963)**	
5	19-29179	See RT/FIMA(64)-2
CONF-550–	**(The International Conference on High-Energy Physics, Dubna, August 5–15, 1964)**	
90	19-29061	See JINR-E-1856
91	19-29057	See ICTP-64/1
92	19-29040	See CALT-68-2
CONF-617–	**(Special Technical Conference on Nuclear Radiation Effects, Seattle, Wash., July 1964)**	
21	19-28909	ORINS. Gmelin, AED-CONF-64-116-35
CONF-623–	19-27909	**(American Medical Association Congress on Environmental Health Problems, Chicago, May 1964)**
CONF-651–	**(9th International Conference on Low Temperature Physics, Columbus, Ohio, Aug. 31–Sept. 4, 1964)**	
67	19-29165	ORINS. Gmelin, AED-CONF-64-140-46
CONF-758–	**(American Physical Society Meeting, New York, Jan. 22–25, 1965)**	
2	19-29232	Dep.(mn); $1.00(cy), 1(mn) CFSTI
19	19-29368	ORINS. Gmelin, AED-CONF-65-003-41
20	19-29377	ORINS. Gmelin, AED-CONF-65-003-42
CONF-794–	**(Magnetism Conference, Minneapolis, Nov. 1964)**	
10	19-28339	ORINS. Gmelin, AED-CONF-64-204-19
CONF-799–	19-28648	**(11th Annual Nuclear Science Symposium, Philadelphia, Oct. 28–30, 1964)**
CONF-630406–	**(11th National Conference on Electromagnetic Relays, Stillwater, Okla., Apr. 23–25, 1963)**	
1	19-28484	ORINS
CONF-631104–	**(Meeting on the Utilization of Research Reactors, Sao Paulo, Brazil, Nov. 4–8, 1963)**	
5	19-29170	See IEA-78
CONF-640602	19-28964	**(Accelerator Targets Designed for the Production of Neutrons Meeting, Liege, Belgium, Feb. 17–18, 1964)**
CONF-640604–	**(3rd Symposium on Engineering Problems in Thermonuclear Research, Munich, June 22–26, 1964)**	
2	19-29392	See IPP-4/12
CONF-640804–	**(11th International Congress of Applied Mechanics, Munich, Aug. 30–Sept. 5, 1964)**	
2	19-29132	See NYO-1480-12
CONF-640810–	**(Conference on Nuclear Marine Propulsion, Blacksburg,**	

Report No.	Abstract No.	Availability
		Va., Aug. 10–13, 1964)
1	19-29733	Dep.(mn); $2.00(cy), 1(mn) CFSTI
CONF-641001–	19-28270	(Symposium on Radiochemical Methods of Analysis, Salzburg, Austria, Oct. 19–23, 1964) See STI-Pub-88
CONF-641112–	19-17327 19-24221 19-28711	(Atomic Industrial Forum, 1964 Annual Conference, San Francisco, Nov. 30–Dec. 3, 1964) Proceedings
CONF-641210–		(American Physical Society Meeting, Berkeley, Calif., Dec. 1964)
2	19-28345	See SC-DC-64-2060
CONF-641214–		(Texas Symposium on Relativistic Astrophysics, Austin, Tex., Dec. 14, 1964)
1	19-29013	See MIT-2098-123
CONF-650105–		(Institute of Electrical and Electronic Engineers, Winter Power Meeting, New York, Jan. 31–Feb. 5, 1965)
1	19-29815	See WAPD-T-1695
CONF-650106		(Conference on Symmetry Principles at High Energy, Coral Gables, Fla., Jan. 1965)
4	19-29075	See UCRL-11971
7	19-29041	See CALT-68-28
CONF-650110–		(The American Nuclear Society Meeting, Santa Fe, N. Mex., Jan. 15, 1965)
1	19-28714	See SC-DC-65-1131
CONF-650207–		(Assn. for Computing Machinery Meeting, Huntsville, Ala., Feb. 12, 1965)
1	19-28733	See ORNL-P-1033
CONF-650217–		(Symposium on Pulsed High Intensity Fission Neutron Sources, Washington, D. C., Feb. 18, 1965)
1	19-29174	See ORNL-P-1116
CONF-650301–		(Symposium on the Physics and Chemistry of Fission, Salzburg, Mar. 22–26, 1965)
12	19-29252	See LA-DC-6674
13	19-29253	See LA-DC-6675
14	19-29259	See PPAD-2137-536
17	19-29369	ORINS
19	19-29378	ORINS
21	19-29381	ORINS
22	19-29379	ORINS
23	19-29382	ORINS
24	19-29373	ORINS
25	19-29372	ORINS
26	19-29371	ORINS
27	19-29370	ORINS
28	19-29374	ORINS
29	19-29375	ORINS
30	19-29376	ORINS
33	19-29380	ORINS
35	19-29247	See JINR-P-2024
CONF-650302–		(IAEA Symposium on Personnel Dosimetry for Accidental High-Level Exposure to External and Internal Radiation, Vienna, Mar. 1965)
8	19-28693	ORINS
16	19-28278	ORINS
CONF-650306–		(Particle Accelerator Conference Mar. 10–12, 1965, Washington, D. C.)
5	19-28934	See BNL-8937
13	19-28935	See BNL-8971
19	19-28936	See BNL-8983
24	19-28965	See UCRL-11798
28	19-28958	See LA-DC-6874
30	19-28957	See LA-DC-6797
34	19-28955	See LA-DC-6757
35	19-28956	See LA-DC-6758
59	19-28964	See ORNL-P-1150
CONF-650313–		(Symposium on Nuclear Medicine, Philadelphia, Mar. 19–20, 1965)
1	19-28419	See BNL-9032
CONF-650401–		(American Chemical Society, Detroit, Apr. 4–9, 1965)
3	19-28290	See UCRL-12260-T
CONF-650407–		(International Symposium on Fission Product Release and Transport Under Accident Conditions, Oak Ridge, Tenn., Apr., 1965)
2	19-28575	See BNL-9173
3	19-28361	See BNL-9174
CONF-650408–		(Transac Users Group, San Antonio, Apr. 21, 1965)
1	19-28727	Dep.(mn); $1.00(cy), 1(mn) CFSTI
CONF-650410–		(American Physical Society, Washington, D. C., Apr. 26–29, 1965)
1	19-29233	Dep.(mn); $1.00(cy), 1(mn) CFSTI
CONF-650413–		(Symposium on Neutron Dynamics and Control, Tucson, Ariz., Apr. 5–7, 1965)
3	19-29178	See RPI-328-31
CONF-650414–		(19th Metallographic Group Meeting, Oak Ridge, Tenn., Apr. 20–22, 1965)
2	19-28739	See RFP-545
CONF-650416–		(4th Symposium on Advanced Propulsion Concepts, Palo Alto, Calif., Apr. 26–28, 1965)
1	19-29734	Dep.(mn); $1.00(cy), 1(mn) CFSTI
CONF-650420–		(5th Panel Meeting on Use of Nuclear Energy in Saline Water Conversion, Vienna, Apr. 5–9, 1965)
1	19-29647	See ORNL-P-1151
CONF-650423–		(International Conference on Physics of Solids and High Pressures, Tucson, Apr. 19–21, 1965)
1	19-28285	See IS-1154
CONF-650501–		(The Application of Computing Methods to Reactor Problems, Argonne, Ill., May 17–19, 1965)
3	19-29166	Dep.(mn); $1.00(cy), 1(mn) CFSTI
5	19-29180	See WAPD-T-1756
CONF-650504–		(IAEA Symposium on Pulsed Neutron Methods, Karlsruhe, Germany, May 10–14, 1965)
2	19-29177	See RPI-328-29
7	19-29169	See GA-6281
CONF-650505–		(IFIP Congress 1965 Meeting, New York, May 24–29, 1965)
2	19-29167	Dep.(mn); $1.00(cy), 1(mn) CFSTI
CONF-650509–		(IAEA Symposium on Nondestructive Testing in Nuclear Technology, Bucharest, May 17–21, 1965)
2	19-29643	See LA-DC-6889
CONF-650510–		(Purdue Conference on Instrumentation for High Energy Physics, Lafayette, Indiana, May 11–15, 1965)
1	19-29068	See MIT-2098-125
CONF-650602–		(American Nuclear Society 11th Annual Meeting, Gatlinburg, Tenn., June 20–24, 1965)
21	19-29576	See BNL-9003
CONF-650611–		(Symposium on Heat Flow Below 100°K and Its Technological Applications, Grenoble, France, June 9–11, 1965)
1	19-28501	See LA-DC-6945
CONF-650703–		(IUPAC Conference on Properties and Uses of Plasma, Moscow, July 19–21, 1965)
1	19-29391	See GA-6330
2	19-29115	See UCRL-12461
COO–		
535-525	19-28999	See UCOL-64-21
535-541	19-28999	See UCOL-64-21
535-543	19-28942	Dep.(mn); $1.00(cy), 1(mn) CFSTI
582-3	19-28325	Talanta, 12: 445-50(1965)
582-4	19-28324	Talanta, 12: 441-4(1965)

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651-13	19-29624	Dep.(mn); $2.00(cy), 1(mn) CFSTI
712-88	19-28626	Dep.; $3.00(cy), 2(mn) CFSTI
1195-8	19-29234	Dep.(mn); $1.00(cy), 1(mn) CFSTI
1233-19	19-29390	Dep.(mn); $1.00(cy), 1(mn) CFSTI
CRE–	**(Canadian)**	
1139	19-28774	$0.50(AECL)
1176	19-28468	Dep.; $1.00(AECL)
1195	19-28775	Dep.; $0.50(AECL)
CU–	**(Misc.)**	
234 and Add.	19-29254	See NEVIS-128 and Add.
CVNA–	**(Misc.)**	
219	19-29625	Dep.(mn); $2.00(cy), 1(mn) CFSTI
221	19-29626	Dep.(mn); $2.00(cy), 1(mn) CFSTI
228	19-29627	Dep.(mn); $4.00(cy), 2(mn) CFSTI
229	19-29628	Dep.(mn); $2.00(cy), 1(mn) CFSTI
231	19-29629	Dep.(mn); $2.00(cy), 1(mn) CFSTI
234	19-29630	Dep.(mn); $2.00(cy), 1(mn) CFSTI
D–	**(Misc.)**	
1-82-0366	19-28976	$2.00(CFSTI)
DCAS-TDR–	**(Non-AEC)**	
62-57	19-28281	See AD-607838
DESY–	**(German)**	
65/1	19-28943	Dep.(mn)
DLCS–		
5001264	19-29631	Dep.(mn); $2.00(cy), 1(mn) CFSTI
DMIC–	**(Non-AEC)**	
213	19-28776	$2.00(CFSTI)
DPST–		
65-83-1	19-28494	Dep.(mn); $1.00(cy), 1(mn) CFSTI
DUBNA REPORTS	**(Russian)**	
See JINR (Russian)		
EANDC-US–	**(European-American Nuclear Data Committee)**	
75(U)	19-29229	See BNL-918
EGG–		
1183-1003	19-29735	Dep.(mn); $1.00(cy), 1(mn) CFSTI
ERS–		
225	19-28705	See TID-21628
ETR–	**(Belgian)**	
163	19-28636	See NP-14874
167	19-28442	See NP-14945
EUR–	**(European Atomic Energy Community)**	
757.i	19-28820	Alluminio, No. 6, 285-9(1964)
1815.e(Rev.)	19-28944	Dep.(mn)
1849.e	19-29632	Dep.(mn)
1910.e	19-29504	Dep.(mn)
2089	19-29472	See EURAEC-1289
2116.f	19-29633	Dep.(mn)
2180.e	19-29736	Dep.(mn)
2183.e	19-28495	Dep.(mn)
2184.e	19-29584	Dep.(mn)
2229.e	19-28496	Dep.(mn)
2236.a	19-28221	Dep.(mn)
2244.e	19-29634	Dep.(mn)
2268.d	19-28613	Arch. Tech. Messen, Lf. 345, 229-30(1964)
2271.f	19-29470	Dep.(mn)
2289.f	19-29471	Dep.(mn)
2297.e	19-28438	Dep.(mn)
2304	19-28811	See EURAEC-1320
2318	19-28518	See EURAEC-1342
2322	19-28871	See EURAEC-1347
2412.e	19-29635	Dep.(mn)
EURAEC–		
1114	19-28497	Dep.(mn); $4.00(cy), 3(mn) CFSTI
1289	19-29472	Dep.(mn); $3.00(cy), 2(mn) CFSTI
1320	19-28811	Dep.(mn); $1.00(cy), 1(mn) CFSTI
1342	19-28518	Dep.(mn); $2.00(cy), 1(mn) CFSTI
1347	19-28871	Dep.(mn); $2.00(cy), 1(mn) CFSTI
1369	19-28574	See BMI-X-10119
1370	19-28870	See BMI-X-10121
1373	19-29640	See GEAP-4842
1374	19-29506	See GEAP-4845
1385	19-28213	See CEND-529
1386	19-28499	See GEAP-4844
1389	19-28490	See ACNP-65002
FD–	**(Non-AEC)**	
127	19-28777	Dep.; $0.50(AECL)
FTD-TT–	**(Non-AEC)**	
64-1104	19-28612	CFSTI
64-1154	19-28757	CFSTI
64-1163	19-28112	CFSTI
64-1164	19-28697	CFSTI
65-53	19-27951	CFSTI
FZK–	**(Non-AEC)**	
197	19-28914	
199	19-29168	
211	19-29505	CFSTI
GA–	**(Misc.)**	
5905	19-29235	$2.00(CFSTI)
6102	19-29032	
6136	19-29236	
6281	19-29169	Dep.(mn); $2.00(cy), 1(mn) CFSTI
6330	19-29391	
GAMD–	**(Misc.)**	
2309	19-29636	Dep.(mn); $3.00(cy), 2(mn) CFSTI
5277	19-29637	Dep.(mn); $2.00(cy), 1(mn) CFSTI
6027	19-28469	Dep.(mn); $1.00(cy), 1(mn) CFSTI
6145	19-29638	Dep.(mn); $2.00(cy), 1(mn) CFSTI
GEAP–	**(Misc.)**	
4637	19-28498	Dep.(mn); $4.00(cy), 3(mn) CFSTI
4772	19-29639	Dep.(mn); $7.00(cy), 7(mn) CFSTI
4842	19-29640	Dep.(mn); $2.00(cy), 1(mn) CFSTI
4844	19-28499	Dep.(mn); $3.00(cy), 2(mn) CFSTI
4845	19-29506	Dep.(mn); $1.00(cy), 1(mn) CFSTI
GEMP–	**(Misc.)**	
190A	19-29737	Dep.(mn); $3.00(cy), 1(mn) CFSTI
GEST–	**(Misc.)**	
2039	19-28872	$3.00(CFSTI)
GH-TM–	**(Non-AEC)**	
190	19-29385	See AD-608794
GH-TR–	**(Non-AEC)**	
0165-00486	19-29384	See AD-607846
HPR–	**(Norwegian)**	
39	19-29708	Dep.(mn)
41	19-29709	Dep.(mn)
49	19-29710	Dep.(mn)
50	19-29711	Dep.(mn)
51	19-29712	Dep.(mn)
56	19-29713	Dep.(mn)
58	19-29714	Dep.(mn)
HW–		
60747(Add.)	19-29717	Dep.(mn); $2.00(cy), 1(mn) CFSTI
74346	19-29778	Dep.(mn); $1.00(cy), 1(mn) CFSTI
82589	19-29738	Dep.; $5.00(cy), 4(mn) CFSTI
84229(Rev.)	19-29779	Dep.(mn); $1.00(cy), 1(mn) CFSTI
84544(App.4)	19-29641	Dep.(mn); $1.00(cy), 1(mn) CFSTI
IA–	**(Non-AEC)**	
1006	19-28990	Dep.(mn)
IC–	**(Misc.)**	
65/16	19-29043	Dep.(mn)
65/21	19-29044	Dep.(mn)

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65/32	19-29045	Dep.(mn)
65/35	19-28728	Dep.(mn)
65/38	19-29046	Dep.(mn)
65/39	19-29047	Dep.(mn)
65/40	19-29048	Dep.(mn)
65/41	19-29049	Dep.(mn)
65/42	19-29050	Dep.(mn)
65/43	19-29051	Dep.(mn)
65/44	19-29052	Dep.(mn)
65/47	19-29053	Dep.(mn)
65/48	19-29054	Dep.(mn)
65/49	19-29055	Dep.(mn)
65/52	19-29056	Dep.(mn)
ICTP–	**(Italian)**	
64/1	19-29057	Dep.(mn)
64/14	19-29058	Dep.(mn)
IDO–		
14642	19-28222	Dep.; $2.00(cy), 2(mn) CFSTI
14648	19-28439	Dep.; $3.00(cy), 1(mn) CFSTI
14652	19-28440	Dep.; $2.00(cy), 1(mn) CFSTI
17002	19-29507	Dep.; $3.00(cy), 2(mn) CFSTI
17048	19-29508	Dep.; $3.00(cy), 2(mn) CFSTI
17058	19-29739	Dep.; $4.00(cy), 2(mn) CFSTI
17073	19-29237	Dep.; $1.00(cy), 1(mn) CFSTI
28641	19-29642	Dep.; $3.00(cy), 2(mn) CFSTI
IEA–	**(Brazilian)**	
78	19-29170	Dep.(mn)
INP–	**(Polish)**	
361	19-29238	Dep.
362	19-29239	Dep.
402/PL	19-29240	Dep.
403/PL	19-29241	Dep.
INR–	**(Polish)**	
517/I/PL	19-28915	Dep.
574/IX-A	19-29509	Dep.
580/V	19-29780	CFSTI
582/XIV,XI	19-28470	Dep.
583/II/PL	19-28629	Dep.
597/VI/PH	19-29059	Dep.
INSJ–	**(Japanese)**	
80	19-29060	Dep.(mn)
84	19-29012	Dep.(mn)
IPP–	**(Non-AEC)**	
4/12	19-29392	Dep.(mn)
IPPJ–	**(Japanese)**	
30	19-29393	Dep.(mn)
31	19-28916	Dep.(mn)
32	19-29394	Dep.(mn)
IS–		
1119	19-29807	Dep.(mn); $1.00(cy), 1(mn) CFSTI
1152	19-28611	Dep.; $3.00(cy), 1(mn) CFSTI
1154	19-28285	Dep.(mn); $1.00(cy), 1(mn) CFSTI
JINR–	**(Russian)**	
E-1856	19-29061	Dep.(mn)
E-2012	19-29242	Dep.(mn)
E-2047	19-29243	Dep.(mn)
P-1937	19-28630	Dep.(mn)
P-1973	19-29244	Dep.(mn)
P-2014	19-29245	Dep.(mn)
P-2017	19-28631	Dep.(mn)
P-2019	19-29246	Dep.(mn)
P-2020	19-29062	Dep.(mn)
P-2024	19-29247	Dep.(mn)
P-2039	19-28991	Dep.(mn)
P-2045	19-29248	Dep.(mn)
P-2048	19-29063	Dep.(mn)
P-2050	19-29064	Dep.(mn)
P-2062	19-29065	Dep.(mn)
P-2068	19-29249	Dep.(mn)
P-2127	19-29066	Dep.(mn)

Report No.	Abstract No.	Availability
JPL-TR–	**(Non-AEC)**	
32-492	19-28634	See N64-20603
32-686	19-29171	
KAPL-M–		
6408	19-29510	Dep.(mn); $1.00(cy), 1(mn) CFSTI
6445	19-29511	Dep.(mn); $2.00(cy), 1(mn) CFSTI
KFK–	**(German)**	
263	19-28632	Dep.(mn)
280	19-28286	Dep.(mn)
281	19-28287	Dep.(mn)
296	19-29250	Dep.(mn)
KR–	**(Norwegian)**	
94	19-29808	Dep.(mn)
LA–		
3242	19-29740	Dep.; $1.00(cy), 1(mn) CFSTI
3257	19-29741	Dep.; $5.00(cy), 3(mn) CFSTI
3267	19-29251	Dep.; $2.00(cy), 1(mn) CFSTI
LA-DC–		
5309	19-28500	Dep.(mn); $2.00(cy), 1(mn) CFSTI
6321	19-28822	Carbon, 2: 269-74(1964)
6390	19-29067	Dep.(mn); $1.00(cy), 1(mn) CFSTI
6625	19-29183	Am. J. Phys., 33: 403-5(1965)
6627	19-28839	Opt. Acta, 11: 287-94(1964)
6674	19-29252	Dep.(mn); $1.00(cy), 1(mn) CFSTI
6675	19-29253	Dep.(mn); $2.00(cy), 1(mn) CFSTI
6733	19-29287	Nucl. Phys., 70: 97-113(1965)
6734	19-28818	Acta Cryst., 18: 1082-3(1965)
6757	19-28955	Dep.(mn); $1.00(cy), 1(mn) CFSTI
6758	19-28956	Dep.(mn); $1.00(cy), 1(mn) CFSTI
6797	19-28957	Dep.(mn); $1.00(cy), 1(mn) CFSTI
6874	19-28958	Dep.(mn); $1.00(cy), 1(mn) CFSTI
6889	19-29643	Dep.(mn); $2.00(cy), 1(mn) CFSTI
6945	19-28501	Dep.(mn); $1.00(cy), 1(mn) CFSTI
LA-tr–		
65-11	19-28506	Dep.(mn); $1.60(fs), $0.80(mf) JCL
LADC–		
6429	19-28977	Dep.(mn); $1.00(cy), 1(mn) CFSTI
6439	19-28288	Dep.(mn); $1.00(cy), 1(mn) CFSTI
6451	19-28729	Dep.(mn); $1.00(cy), 1(mn) CFSTI
6488	19-29172	Dep.(mn); $1.00(cy), 1(mn) CFSTI
LNF–	**(Italian)**	
64/55	19-28959	Dep.(mn)
64/69	19-28917	Dep.(mn)
MF–	**(Misc.)**	
44	19-29132	See NYO-1480-12
MIT–	**(Misc.)**	
2098-51	19-28633	Dep.(mn); $1.00(cy), 1(mn) CFSTI
2098-97	19-29021	Nature, 206: 703-4(1965)
2098-123	19-29013	Dep.(mn); $1.00(cy), 1(mn) CFSTI
2098-125	19-29068	Dep.(mn); $1.00(cy), 1(mn) CFSTI
ML-TDR–	**(Non-AEC)**	
64-268	19-28217	See AD-608074
MLM–		
1189(Suppl.)	19-28918	Dep.(mn); $1.00(cy), 1(mn) CFSTI
1221	19-28717	Dep.(mn); $1.00(cy), 1(mn) CFSTI
MND–	**(Misc.)**	
3043-1	19-28713	Dep.(mn); $2.00(cy), 1(mn) CFSTI
MURA–	**(Misc.)**	
709	19-28960	Dep.; $2.00(cy), 1(mn) CFSTI
711	19-28961	Dep.; $1.00(CFSTI)
N–	**(Misc.)**	
64-20603	19-28634	$6.60(CFSTI)
64-29574	19-29730	See 64SD-913
65-16202	19-29235	See GA-5905
65-17270	19-29745	See NASA-CR-54234(Vol.I)

Report No.	Abstract No.	Availability
65-17271	19-29746	See NASA-CR-54234(Vol.II)
65-17272	19-29747	See NASA-CR-54234(Vol.III)
65-17273	19-29748	See NASA-CR-54234
65-19263	19-28872	See GEST-2039
NAA-SR–		
10154	19-29644	Dep.; $2.00(cy), 1(mn) CFSTI
10735	19-29742	Dep.; $3.00(cy), 2(mn) CFSTI
10817	19-29645	Dep.; $3.00(cy), 2(mn) CFSTI
10853	19-29173	Dep.(mn); $1.00(cy), 1(mn) CFSTI
NAA-SR-Memo–		
10784	19-29033	Dep.(mn); $2.00(cy), 1(mn) CFSTI
10881	19-29440	Dep.(mn); $3.00(cy), 2(mn) CFSTI
10694	19-29743	Dep.(mn); $1.00(cy), 1(mn) CFSTI
NASA-CR–	**(Misc.)**	
151	19-29014	$3.00(CFSTI)
214	19-29744	$3.00(CFSTI)
54161	19-29730	See 64SD-913
54234(Vol.I)	19-29745	$4.00(CFSTI)
54234(Vol.II)	19-29746	$4.00(CFSTI)
54234(Vol.III)	19-29747	$3.00(CFSTI)
54234(Vol.IV)	19-29748	$2.00(CFSTI)
54262	19-29235	See GA-5905
54267	19-28872	See GEST-2039
54310	19-29749	
54352	19-28502	See PWA-2530
56038	19-28634	See N64-20603
NASA-TN–	**(Misc.)**	
D-2782	19-29441	$2.00(CFSTI)
D-2806	19-29395	$1.00(CFSTI)
NC–	**(Norwegian)**	
64	19-29784	See TID-21794
NEVIS–	**(Misc.)**	
128 and Add.	19-29254	
NIJS-R–	**(Yugoslavian)**	
440	19-28441	Dep.(mn)
NIRL-R–	**(British)**	
73	19-28730	Dep.(mn)
81	19-28962	Dep.(mn)
NOLTR–	**(Misc.)**	
64-220	19-28635	Dep.(mn); $2.00(cy), 2(mn) CFSTI
NP–	**(AEC File No. for Non-AEC Reports)**	
14588	19-29781	Dep.(mn); $5.00(cy), 3(mn) CFSTI
14617	19-29646	
14659	19-29069	Dep.(mn)
14723	19-28963	Dep.(mn)
14730	19-28539	Dep.(mn)
14824	19-28731	
14825	19-28420	Dep.(mn)
14873	19-29255	Dep.(mn)
14874	19-28636	Dep.(mn); $2.00(cy), 1(mn) CFSTI
14913	19-28919	Dep.(mn)
14945	19-28442	Dep.(mn); $3.00(cy), 2(mn) CFSTI
14959	19-29070	Dep.(mn)
14973	19-28223	Dep.(mn)
14974	19-29585	Dep.(mn)
14985	19-29750	Dep.(mn)
15008	19-29256	Dep.(mn)
15010	19-29071	Dep.(mn)
15012	19-29257	Dep.(mn)
15014	19-29072	Dep.(mn)
15040	19-28111	
15049	19-28738	Dep.(mn)
15050	19-29258	Dep.(mn)
15052	19-28421	Dep.(mn)
15070	19-29073	Dep.(mn)
NP-tr–	**(AEC File No. for Non-AEC Translations)**	
1227	19-28132	Dep.(mn); $2.60(fs), $0.83(mf) JCL
1231	19-28228	Dep.(mn); $2.60(fs), $1.07(mf) JCL

Report No.	Abstract No.	Availability
NRL–	**(Misc.)**	
6213	19-28289	$1.00(CFSTI)
6251	19-29751	$2.00(CFSTI)
NSL–	**(Misc.)**	
64-136-1	19-27948	See TID-21862
NYO–		
1480-12	19-29132	Dep.(mn); $1.00(cy), 1(mn) CFSTI
2150-4	19-29156	Dep.(mn); $1.00(cy), 1(mn) CFSTI
10221	19-29133	Dep.; $2.00(cy), 1(mn) CFSTI
10508	19-29809	Dep.(mn); $2.00(cy), 2(mn) CFSTI
ORA–	**(Misc.)**	
04289-3F	19-27947	See TID-20745
ORNL–		
3739	19-28214	Dep.; $3.00(cy), 2(mn) CFSTI
3743	19-28732	Dep.; $4.00(cy), 2(mn) CFSTI
3758	19-28978	Dep.; $2.00(cy), 1(mn) CFSTI
3765	19-29803	Dep.; $1.00(cy), 1(mn) CFSTI
3785	19-28443	Dep.; $5.00(cy), 4(mn) CFSTI
3795	19-28812	Dep.; $2.00(cy), 1(mn) CFSTI
3806	19-27896	Dep.; $2.00(cy), 1(mn) CFSTI
3809	19-28126	Dep.; $3.00(cy), 1(mn) CFSTI
3813	19-28992	Dep.; $3.00(cy), 2(mn) CFSTI
3823	19-28755	Dep.; $3.00(cy), 1(mn) CFSTI
ORNL-P–	**(Misc.)**	
115	19-27897	Dep.(mn); $1.00(cy), 1(mn) CFSTI
637	19-28758	J. Electrochem. Soc., 112: 546-53(1965)
990	19-29294	Nucl. Phys., 70: 177-95(1965)
1033	19-28733	Dep.(mn); $1.00(cy), 1(mn) CFSTI
1086	19-29151	Nature, 206: 499-500(1965)
1116	19-29174	Dep.(mn); $1.00(cy), 1(mn) CFSTI
1150	19-28964	Dep.(mn); $1.00(cy), 1(mn) CFSTI
1151	19-29647	Dep.(mn); $2.00(cy), 1(mn) CFSTI
ORNL-TM–		
967	19-29299	Nucl. Phys., 70: 225-35(1965)
998	19-28637	Dep.(mn); $1.00(cy), 1(mn) CFSTI
1029	19-28756	Dep.(mn); $2.00(cy), 1(mn) CFSTI
1055	19-28638	Dep.(mn); $6.00(cy), 4(mn) CFSTI
1057	19-29648	Dep.(mn); $1.00(cy), 1(mn) CFSTI
1079	19-29782	Dep.(mn); $2.00(cy), 1(mn) CFSTI
1094	19-28444	Dep.(mn); $2.00(cy), 1(mn) CFSTI
ORNL-tr–		
632	19-28815	Dep.(mn); $1.60(fs), $0.80(mf) JCL
OTS–	**(Misc.)**	
63-11455/3-4	19-27899	$5.00(CFSTI)
P–	**(Misc.)**	
1495(RAND)	19-29175	$1.00(CFSTI)
2881-1(RAND)	19-28526	$3.00(CFSTI)
PAN–	**(Polish)**	
539/IX	19-29176	Dep.
565/IX,XI	19-29783	Dep.
PATENTS	**(British)**	**3s. 6d. each, U. K. Patent Office**
983,938	19-29483	
984,128	19-29484	
984,156	19-28517	
984,240	19-28694	
984,758	19-28623	
984,834	19-28695	
985,029	19-28415	
985,074	19-29036	
985,186	19-29037	
985,286	19-28434	
985,305	19-29485	
985,307	19-29486	
985,383	19-28340	
985,400	19-28455	
985,463	19-29581	
985,464	19-29698	
985,550	19-29805	
985,646	19-29699	

Report No.	Abstract No.	Availability
985,647	19-29700	
985,668	19-28456	
985,728	19-29701	
985,761	19-28485	
985,762	19-28486	
985,782	19-28724	
985,872	19-28416	
985,890	19-28608	
985,969	19-29487	
986,051	19-29600	
986,052	19-29601	
986,112	19-28793	
986,179	19-28794	
986,188	19-29798	
986,215	19-28749	
986,294	19-28457	
986,474	19-29488	
986,489	19-29582	
986,674	19-28458	
986,701	19-28750	
986,852	19-28341	
986,939	19-29602	
987,075	19-29603	
987,164	19-29489	
987,171	19-28487	
987,299	19-28488	
987,462	19-28571	
987,548	19-29490	
987,651	19-28459	
987,705	19-29604	
987,786	19-28795	
987,880	19-29491	
987,988	19-28796	
PATENTS	**(Canadian)**	
674,964	19-28751	
675,141	19-28797	
675,512	19-28342	
677,232	19-29492	
677,509	19-29853	
678,995	19-29605	
679,457	19-29799	
679,458	19-29800	
680,821	19-29606	
681,350	19-29774	
682,040	19-29493	
683,403	19-29494	
684,187	19-29702	
684,327	19-29703	
684,740	19-29495	
684,770	19-28460	
684,816	19-29496	
684,827	19-29607	
684,890	19-29497	
685,238	19-28489	
685,380	19-29801	
685,680	19-29498	
685,774	19-28752	
686,282	19-29802	
688,831	19-29608	
689,687	19-28704	
689,709	19-29704	
690,135	19-29609	
690,281	19-29499	
690,964	19-28798	
691,114	19-29705	
692,225	19-28799	
692,356	19-29775	
692,475	19-29500	
692,479	19-29706	
693,038	19-28358	
PATENTS	**(German)**	
1,183,061	19-28772	
1,184,745	19-28461	
1,185,596	19-28753	
1,186,842	19-28279	
1,186,956	19-29501	
1,187,232	19-28754	
1,189,214	19-29473	

Report No.	Abstract No.	Availability
PATENTS	**(U. S.)**	**$0.25 each, U. S. Patent Office**
3,146,366	19-29222	
3,154,375	19-28462	
3,172,741	19-28463	
3,172,742	19-28464	
3,173,004	19-28624	
3,173,006	19-28975	
3,173,013	19-29223	
3,181,700	19-28465	
3,182,102	19-28800	
3,182,280	19-29818	
3,182,499	19-29819	
3,183,059	19-28466	
3,183,061	19-28343	
3,183,166	19-28910	
3,183,499	19-29820	
3,183,936	19-29821	
3,184,849	19-29822	
3,185,063	19-29823	
3,185,548	19-28344	
3,188,169	19-28280	
3,188,231	19-28801	
3,188,278	19-29707	
3,188,470	19-29575	
3,189,023	19-29824	
3,189,419	19-29825	
3,189,445	19-28802	
3,189,446	19-28803	
3,189,476	19-28804	
3,189,666	19-28805	
3,189,817	19-28523	
3,191,092	19-28532	
3,191,662	19-29826	
3,191,792	19-29827	
3,192,054	19-28712	
3,192,122	19-28806	
PB–	**(Non-AEC)**	
181694	19-29649	$2.75(CFSTI)
PNE–		
457	19-29810	Dep.(mn); $1.00(cy), 1(mn) CFSTI
600F	19-28474	Dep.; $4.00(CFSTI)
610F	19-28475	Dep.; $0.50(cy), 1(mn) CFSTI
PPAD–		
2137-536	19-29259	Dep.(mn); $1.00(cy), 1(mn) CFSTI
PWA–	**(Non-AEC)**	
2530	19-28502	
R–	**(Misc.)**	
6SSD-7	19-29396	
473 and Add.	19-29254	See NEVIS-128 and Add.
RADC-TDR–	**(Misc.)**	
64-453	19-28931	See AD-608899
64-458	19-29111	See AD-611161
RFP–		
531	19-28215	Dep.; $1.00(cy), 1(mn) CFSTI
545	19-28739	Dep.(mn); $1.00(cy), 1(mn) CFSTI
RISO–	**(Danish)**	
88	19-28734	Dep.(mn)
RL-NRD–		
81	19-29718	Dep.(mn); $1.00(cy), 1(mn) CFSTI
RL-REA–		
183	19-29719	Dep.(mn); $1.00(cy), 1(mn) CFSTI
RPI–	**(Misc.)**	
328-29	19-29177	Dep.(mn); $1.00(cy), 1(mn) CFSTI
328-31	19-29178	Dep.(mn); $2.00(cy), 1(mn) CFSTI
RT/FIMA–	**(Italian)**	
(64)-2	19-29179	Dep.(mn)
SC-DC–		

Report No.	Abstract No.	Availability
64-2060	19-28345	Dep.(mn); $1.00(cy), 1(mn) CFSTI
65-1131	19-28714	Dep.(mn); $1.00(cy), 1(mn) CFSTI
SC-T-		
65-728	19-29135	Dep.(mn); $6.60(fs), $2.03(mf) JCL
65-733	19-28557	Dep.(mn); $1.10(fs), $0.80(mf) JCL
SCL-DC-		
65-52	19-29811	Dep.; $3.00(cy), 2(mn) CFSTI
SGAE-CH-	**(Austrian)**	
12/1964	19-28740	Dep.(mn)
13/1964	19-28224	Dep.(mn)
15/1965	19-28741	Dep.(mn)
SGAE-PH-	**(Austrian)**	
11/1964	19-28225	Dep.(mn)
SM-	**(Misc.)**	
46276	19-29750	See NP-14985
SRI-	**(Misc.)**	
1-174	19-28556	See VUP-2100
SRIA-		
425-4	19-29812	Dep.(mn); $3.00(cy), 2(mn) CFSTI
SROO-		
260-6	19-28503	Dep.(mn); $6.00(cy), 4(mn) CFSTI
SSD-TDR-	**(Non-AEC)**	
64-184	19-29397	
STI-DOC-	**(International Atomic Energy Agency)**	
10/36	19-29697	$2.00; S 42,-; 12/-stg; F.Fr. 8,-; DM 6.40 (IAEA)
STI-PUB-	**(International Atomic Energy Agency)**	
88(Vol.I)	19-28270	$9.00; S 189.-; £2.14.0; F.Fr. 36.-; DM 31.50(IAEA)
SU-SEL-	**(Misc.)**	
64-063	19-29134	$6.00(CFSTI)
T-	**(Misc.)**	
290-R	19-28874	See AD-610971
TE-	**(Non-AEC)**	
7-65	19-29029	See AD-607528
TID-		
3522(7th Rev., Suppl.1)	19-28476	Dep.; $2.00(cy), 1(mn) CFSTI
7022(Vol.I)(Bk.3)	19-28226	Dep.; $3.50(cy), 6(mn) CFSTI
7022(Vol.I)(Bk.5)	19-28227	Dep.; $3.75(cy), 6(mn) CFSTI
19014	19-27912	Dep.(mn); $1.00(cy), 1(mn) CFSTI
20741	19-29813	Dep.(mn); $1.00(cy), 1(mn) CFSTI
20745	19-27947	Dep.(mn); $2.00(cy), 1(mn) CFSTI
21546	19-28735	Dep.(mn); $2.00(cy), 1(mn) CFSTI
21628	19-28705	Dep.; $2.00(cy), 1(mn) CFSTI
21662	19-28346	Dep.(mn); $1.00(cy), 1(mn) CFSTI
21744	19-29260	Dep.(mn); $1.00(cy), 1(mn) CFSTI
21794	19-29784	Dep.(mn); $1.00(cy), 1(mn)
21823	19-29261	Dep.(mn); $3.00(cy), 2(mn) CFSTI
21828	19-29262	Dep.(mn); $1.00(cy), 1(mn) CFSTI
21830	19-28639	Dep.(mn); $2.00(cy), 1(mn) CFSTI
21855	19-28471	Dep.(mn); $2.00(cy), 1(mn) CFSTI
21862	19-27948	Dep.(mn); $1.00(cy), 1(mn) CFSTI
21870	19-28130	Dep.(mn); $1.00(cy), 1(mn) CFSTI
21874	19-28873	Dep.(mn); $4.00(cy), 3(mn) CFSTI
21885	19-28362	Dep.(mn); $3.00(cy), 2(mn) CFSTI
21889	19-27949	Dep.(mn); $6.00(cy), 4(mn) CFSTI
21892	19-28540	Dep.(mn); $3.00(cy), 2(mn) CFSTI
TM-	**(Misc.)**	
64-8-14	19-29733	See CONF-640810-1
TR-	**(Misc.)**	
59-0000-00674	19-28491	See AD-607555
65-17	19-28555	See AD-612711
TT-	**(Canadian)**	
59-15266	19-28874	See AD-610971
UCD-		
472-111	19-27950	Dep.; $4.00(cy), 3(mn) CFSTI
UCOL-		
64-21	19-28999	Phys. Rev., 139: A15-18(1965)
65-39	19-28942	See COO-535-543
UCRL-		
7738(Rev.I)	19-28535	J. Geophys. Res., 70: 2377-93(1965)
7785-T	19-28920	Dep.(mn); $1.00(cy), 1(mn) CFSTI
7794	19-28524	Dep.(mn); $2.00(cy), 2(mn) CFSTI
7799	19-28640	Dep.(mn); $1.00(cy), 1(mn) CFSTI
7806	19-29814	Dep.(mn); $1.00(cy), 1(mn) CFSTI
7826	19-28993	Dep.(mn); $1.00(cy), 1(mn) CFSTI
7841	19-28778	Dep.(mn); $1.00(cy), 1(mn) CFSTI
7895	19-28921	Dep.(mn); $1.00(cy), 1(mn) CFSTI
7896	19-27898	Dep.(mn); $1.00(cy), 1(mn) CFSTI
7906-T	19-28615	IEEE (Inst. Elec. Electron. Engrs.), Trans. Nucl. Sci., NS-12: 66-82(1965)
7947(Rev.I)	19-28666	See UCRL-7947-T
7947-T	19-28666	Trans. Nucl. Sci., NS-12: 314-24(1965)
7957	19-28669	Trans. Nucl. Sci., NS-12: 356-60(1965)
10316	19-28813	Dep.(mn); $2.00(cy), 1(mn) CFSTI
11486	19-29265	Arkiv Fysik, 28: 375-9(1964)
11798	19-28965	Dep.(mn); $1.00(cy), 1(mn) CFSTI
11884	19-29074	Dep.; $2.00(cy), 1(mn) CFSTI
11971	19-29075	Dep.(mn); $3.00(cy), 2(mn) CFSTI
12115	19-28819	Acta Cryst., 18: 1085-6(1965)
12167	19-28576	Dep.; $3.00(cy), 2(mn) CFSTI
12234	19-29398	Dep.; $1.00(CFSTI)
12260-T	19-28290	Dep.(mn); $1.00(cy), 1(mn) CFSTI
12268	19-29003	Phys. Rev., 139: A40-2(1965)
12343	19-29114	Dep.; $1.00(cy), 1(mn) CFSTI
12356	19-28504	Dep.; $1.00(cy), 1(mn) CFSTI
12378	19-28577	Dep.; $1.00(cy), 1(mn) CFSTI
12460-T	19-28308	J. Am. Chem. Soc., 87: 2290-1(1965)
12461	19-29115	Dep.(mn); $1.00(cy), 1(mn) CFSTI
12492	19-28131	Dep.; $1.00(cy), 1(mn) CFSTI
16009	19-28363	Dep.(mn); $4.00(cy), 2(mn) CFSTI
UCRL-Trans-		
1085(L)	19-28579	Dep.(mn); $2.60(fs), $0.98(mf) JCL
1196(L)	19-27913	Dep.(mn); $1.60(fs), $0.80(mf) JCL
UJV-	**(Czechoslovakian)**	
1167/64	19-28422	Dep.(mn)
1168/64	19-28445	Dep.(mn)
1169/64	19-28364	Dep.(mn)
1170/64	19-28365	Dep.(mn)
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